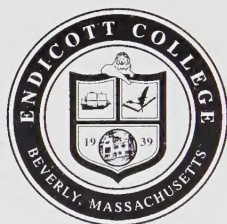


Carpets and Rugs

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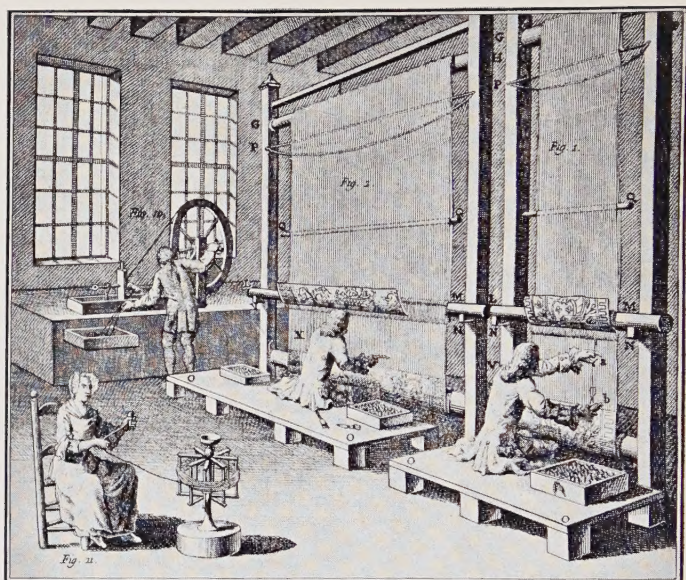


FIGURE 1

Weavers at work in the Louvre (reproduced from illustration in Duhamel du Monceau's "Art de Faire Les Tapis Facon de Turquie," printed in 1766). The woman in the foreground (Fig. 11) is winding yarn for pile onto bobbins. The man in the background (Fig. 10) is mixing colors to get a given shade by winding yarn from bobbins of different colors onto the same bobbin, giving a yarn made up of several strands of different colors which is used by the weaver. The weavers tie knots of pile around the warp threads (Fig. 1) changing bobbins to conform to the colors called for by the pattern. When a row of knots has been tied, they are beaten up against the completed fabric with a comb as shown in Fig. 2.

Carpets and Rugs

How they are made

How to select them

How to care for them

by

OTIS ALLEN KENYON

THE HOOVER COMPANY

NORTH CANTON, OHIO

1923

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FOREWORD

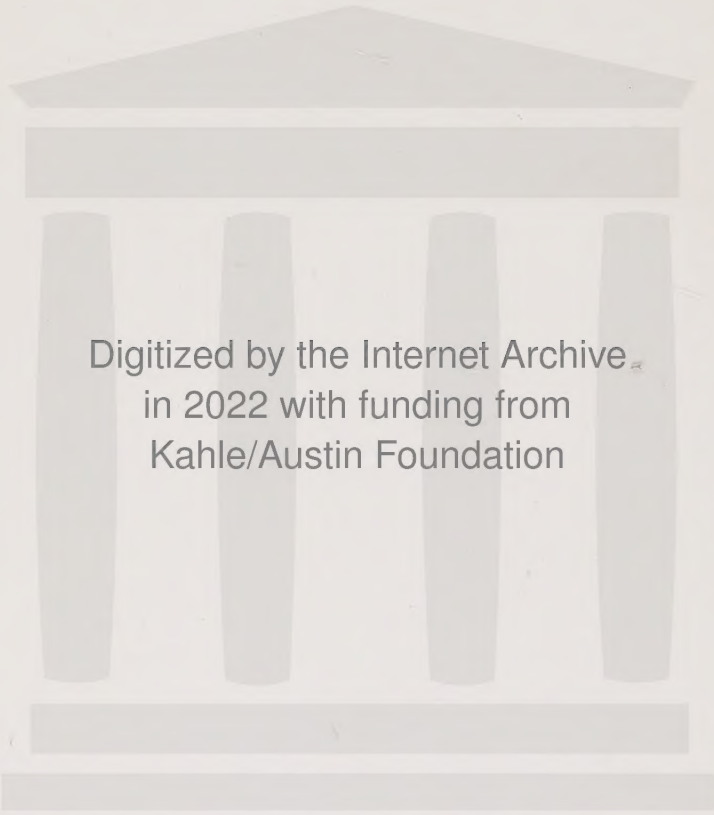
To most of us, carpets, like many other things intimately associated with our daily life, are a closed book. There is probably not a home in the United States that does not count some kind of carpet among its possessions, and yet it can be safely said that not one person in twenty thousand can tell one kind of carpet from another—to say nothing of how they are made or how to take proper care of them.

Being deeply interested in carpets, we have studied the subject by research, by conversations with experts, and by numerous visits to carpet mills and rug weaving establishments. Believing that the knowledge we possess of this vast and intricate art might be of value to the average rug owner or buyer, we have endeavored to set forth in this publication such information as we think will stimulate an interest in floor coverings.

To know a thing is to enjoy it, and from our experience we believe that the brief story here presented will help its readers to appreciate and enjoy fine rugs. With this knowledge, the purchase of a fine rug becomes a rare pleasure and the care of such rugs a serious duty.

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CARPETS AND RUGS

CHAPTER I

HISTORICAL

When or where carpet making began no one knows. It is known that weaving in its simplest form is one of the oldest arts practiced by man. Indeed it ranks, as far as age is concerned, with the carving of wood and the molding of clay. So far as we can tell the first weaving must have been of the plain basket type, using grasses, split reeds, palm leaves and other long-fibered vegetable growths.

The invention of spinning, which permitted the conversion of small animal hairs and other soft, fine fibers into long fibrous threads, marked the greatest epoch in the development of weaving, as it opened the door to the very best accomplishment known to us today.

With spinning came, as a natural sequence, wool, silk, cotton and linen threads, and then followed the coloring of these various fibers with the juices of plants, flowers and insects.

The availability of colored threads naturally led to the use of figures for decorative purposes, the logical outcome of which was the development of the art of design. With design, dyeing, spinning and weaving, the elements necessary to the

production of carpets and rugs as we know them at the present time, it was simply a matter of improvement along each of these various lines.

Although it is not known where the making of carpets originated, it is known that the zenith of its development occurred in the Orient, because it is there that the finest specimens have been found.

It has been claimed by rug experts that the most perfect carpets of which we have any knowledge were made in Babylon and Nineveh, which cities were at the height of their prosperity between 3000 and 538 B. C., the latter date marking the fall of Babylon into the hands of Cyrus, at the head of the Persians.

That part of Asia now occupied by Persia and Asia Minor has been the battleground of the world for thousands of years, and all the races of Asia and most of those of Europe have fought there; first one and then another dominating. Through all these upheavals, the making of rugs and carpets has persisted, first developing to the pinnacle of achievement, and then, under commercializing methods, declining to its present-day state.

The carpets that were made in the Orient centuries ago cannot be duplicated today. The ancient Oriental rug maker was an artist, and his work had the same individual characteristics as the work of any true artist. Time did not enter into his calculations; he thought only of the achievement of his highest and best conceptions—a woven picture in rug or carpet form.

Antique rugs are inimitable in their coloring. The secrets of the ancient dye maker were well guarded, and many of his practices disappeared with him. It is true that our modern methods give us all the colors, but we do not get the same color blends and effects nor the same soft aging qualities.

Carpets in Europe

From the Orient, carpets and rugs worked their way westward into Europe, and the art of weaving such fabrics, with the Saracens, filtered up through Spain and Italy.

Authorities differ by several hundred years in their estimate of the date when Oriental weaving was introduced into Europe. According to Duhamel du Monceau, there were Saracens who practiced carpet weaving in France at the time of Charles Martel, early in the eighth century.

In the archives of Paris there are documents which prove the existence of Saracen weavers in 1295. These dates are considerably earlier than generally conceded. Most authorities agree that Oriental carpet-weaving establishments were conducted in Spain and Italy by Saracens during the fourteenth century.

The first official support of Oriental carpet weaving in France was rendered in 1608 by King Henry IV, who, recognizing the artistic talent and ability of Pierre Dupont, awarded him a title and

provided space and equipment for his weavers in the Louvre.

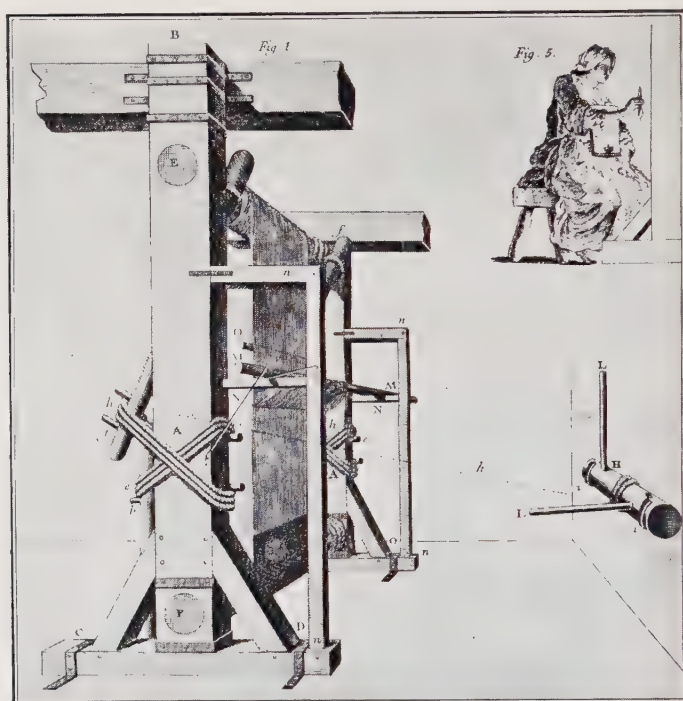


FIGURE 2

Reproduction from illustration in Duhamel du Monceau's "*Art de Faire Les Tapis Facon de Turquie*," printed in 1766, showing the vertical looms used in the Louvre. The warp threads are stretched between beams F and E (Fig. 1), and as the weaving proceeds the completed fabric is wound up at the bottom. The shed is formed by means of the poles Q and M. Q passes between the warp threads, every other one being on the same side of the stick. Those threads which go behind the stick, Q, pass through loops fastened to the pole, M, so that when the loops of pole, M, are pulled forward, the warp threads from the back are brought to the front. The weaver (Fig. 5) holding an oil lamp with a reflector in her lap and shears in her left hand is about to insert a bobbin of weft thread into the warp. She works with these small bobbins—one for each color or shade.

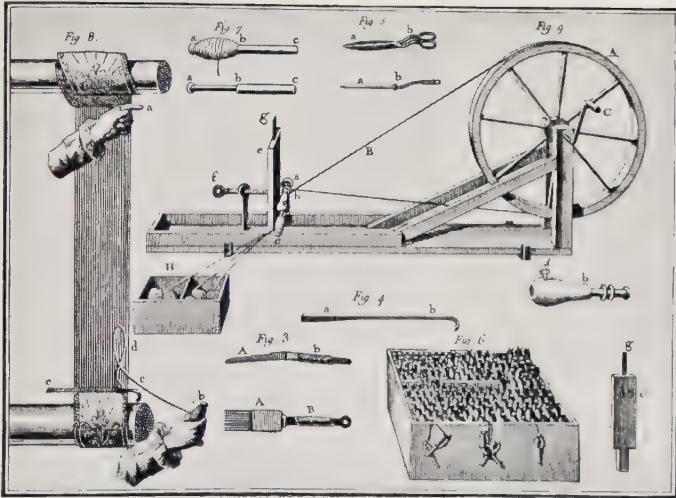


FIGURE 3

Some of the tools and machinery used by the weavers in the Louvre (reproduced from illustration in Duhamel du Monceau's "*Art de Faire Les Tapis Façon de Turquie*," printed in 1766). The bobbin winder (Fig. 9) was merely a speed ratio device which enabled the worker to turn the bobbin, c, at a fast speed with a slow turning of the crank, C. The weaving bobbins are shown in Fig. 7; the shears for clipping the pile in Fig. 5; the knife for cutting pile loops of the running knots in Fig. 4; the comb for beating the pile tightly against the finished fabric as the rows of knots are tied in Fig. 3; Fig. 8 shows how the loops of pile are made and how the weaver separates the warp threads by pulling the loops, a, through which alternate pile threads pass.

The looms and the practices employed at that time are well illustrated by drawings reproduced from an article written by Duhamel du Monceau in 1766 and published in the proceedings of the Academie Royale des Sciences. See Figures 1 to 3.

About ten years after the carpet industry was established in the Louvre, Pierre Dupont and Simon Lourdet started another carpet weaving es-

tablishment at Chaillot, in a building that was formerly used as a soap factory (*Savonnerie*). Oddly enough, the carpets produced in this establishment became known as *Savonnerie carpets*, and the name is still used to designate the type of carpet there developed.

Louis XIV, like King Henry IV, did much to develop manufacturing industries in France. He established a new factory at Beauvais, reorganized the Louvre and the *Savonnerie* factories, and engaged the most famous painters of his time to supply designs for the weavers.

The weaving industry, like many other French industries, was largely in the hands of Protestants, and therefore when Louis XIV, under the influence of his new wife, revoked the Edict of Nantes in 1685 and allowed the persecution of the Protestants, he dealt industrial France a crushing blow, as practically all the Protestant weavers fled to Holland, Germany and England, where they resumed their trade.

Carpets in Great Britain

In the westward movement of carpet weaving, Great Britain followed Spain, Italy, France, Belgium and other countries of Europe. There was practically no carpet weaving in Great Britain until the Edict of Nantes, which caused great numbers of weavers to flee to England.

Once started, the industry of weaving grew rapidly. Two of the most important centers of

activity were the towns of Kidderminster and Wilton.

The European weavers had not been satisfied with the slow and tedious methods employed by the Orientals, and therefore began at once to devise weaving methods that were quicker and less laborious. The Ingrain carpet was one of the first attempts.

In the beginning practically all carpets woven in England were of the *Ingrain* type. In 1745 a factory in Wilton started to make cut-pile, or *Wilton* carpets, and in a few years this lead was followed by Kidderminster.

The first Brussels loom was introduced from Belgium into England in 1745 by John Broom, a Kidderminster weaver, who went to the continent to study methods of weaving and learned how to build the loom and operate it. Kidderminster later became the chief seat of the Brussels and Wilton carpet industry.

At about this time Axminster became the seat of the imitation Oriental carpet industry, so that certain imitation Oriental carpets were known as *Axminsters*. The Axminster of today is a machine-made carpet of the Oriental type, and stands at the head of the list of modern carpets.

Mr. Richard Whytock of Edinburgh, Scotland, invented in 1831 a type of carpet which has since developed into two types, *Tapestry* (Tapestry Brussels) and *Velvet* (Tapestry Velvet) depending upon whether the pile is looped or cut.

Patent Axminster, or *Chenille*, was invented in 1839 by two Scotchmen, James Templeton and William Quigley.

Carpets in the United States

For many years the United States bought practically all its carpets from England, and when the time came to manufacture carpeting in this country, it was England who contributed most of the skilled labor and machinery. Although the first carpet mill operated in the United States was established in 1791, it was not until some fifty years later that the industry reached any important proportions. This first mill was set up in Philadelphia by William Peter Sprague, and Philadelphia is still one of the most important carpet centers in the United States.

Our chief contribution to the carpet industry was made by Erastus B. Bigelow, who invented the *power loom*. He began his work in 1839 and continued it over a period of years. Beginning with Ingrain carpet, the power loom has been applied to the manufacture of all modern carpets, and in this way the production capacity of looms has been increased in some cases as much as ten-fold.

Another important contribution to the carpet industry is the machine-made Axminster, originally known as *Moquette*, an invention of Halcyon Skinner. This invention was made in 1876 while

Mr. Skinner was in the employ of Alexander Smith. The Skinner loom was introduced into England by Messrs. Tomkinson & Adam of Kidderminster. In the United States the machine-made Axminster was first known as Moquette and later as Royal Axminster.

CHAPTER II

CARPET TYPES

If it were undertaken to list all trade-names for Oriental, hand-made and machine-made carpets, the task of describing these carpets would extend far beyond the scope of this publication. However, if the classification is based on the method of weaving, or rather on the structure of the carpet, this myriad of types reduces to a relatively small number. Most of the trade-names have been devised to distinguish the different grades produced by certain manufacturers, or dealers, and many times they are quite misleading. Fortunately, there are not many more than a half dozen fundamental types, and it is not beyond the realm of possibility for the layman to learn enough about carpets to be able to place machine-made carpets in their proper class, irrespective of their trade-name.

The main types of carpet on the market today are: Oriental, European hand-tufted, Axminster, Velvet, Wilton, Tapestry, Brussels and Chenille. Ingrain, the carpet of our grandfathers, is rapidly disappearing from homes in this country, because of its poor wearing qualities and its inferior appearance and therefore will not be covered in this book.

Of the hand-made carpets the Oriental is commercially by far the most important, as it is only

in the Orient that hand-made carpets can be woven at a cost that will permit pricing within the reach of any large number of people. In Austria, Germany, Holland, France, England, Spain and Italy many fine hand-tufted rugs are made, but they are too expensive for stock weaving and therefore are limited to special orders. In the special-order field, however, they have an advantage over the machine-made carpets in quality and often in cost as well.

Axminster was originally a hand-made carpet but at the present time it is all made by machine. The rest of the carpets listed above are all machine-made. They differ from one another in the materials used, methods employed in weaving and limitations as to colors, sizes, etc. Each one of these principal types is taken up separately later on.

CHAPTER III

ORIENTAL CARPETS

In the days before the carpet industry of the Orient was commercialized, the Oriental made carpets for his own use, as gifts to his friends, or as offerings to his gods. Under these conditions it was natural that greater artistic ability and skill obtained than under present commercial conditions, because the carpet makers then put their souls into their work, and the whole idea was to produce a fine carpet, while now it is merely a question of making money.

It has been marvelled by some that an art such as carpet making which has been in constant and increasing application, could at the same time lose many of its finer points. It does seem strange that certain branches of the art have become extinct and certain practices entirely lost, while there has been no interruption in the production of carpets since the time in which these various lost practices were in common use.

The answer to this riddle is, that the modern methods which have been substituted for the older and better methods are easier in application, and therefore when carpets are made for sale rather than for the maker's own use, he naturally turns to the easiest method rather than the best one, and since none of the old formulas for dyeing the



FIGURE 4

Weaving with an upright loom. The yarn which is used for the pile is hung above the weavers. The pole which is used for separating the warp threads, so as to insert the weft, may be seen at about the height of the weavers' heads. Each weaver covers a width of approximately 27 inches and as the work progresses the seat is moved up the ladder.

carpets were recorded in any way, except in the minds of the men who used them, they disappeared with those men.

It is a fact that many of the colors used in ancient times cannot be duplicated at the present time, except by artificial fading of the colors.

There is little use in discussing the antique Oriental rug in this book, as there are practically no real antique Orientals on the market today. However, there are many excellent modern Orientals that are made under the supervision of broad-minded men who realize that if the Oriental rug is not to disappear entirely from the markets of the world, its standard of quality must be maintained.

Wool

The pile or face of Oriental carpets is usually of wool but in rare instances silk and camel hair are used. The warp and weft which form the body of the fabric are also made of wool, but usually of cotton, sometimes of hemp. However, wool is of such overshadowing importance and so preponderates in the construction of all Oriental carpets that for the purposes of this book everything except wool will be ignored.

The best wool for use in carpet making is that derived from half-wild sheep raised in the mountainous districts of southern Asia. The superiority of this wool is due to its extraordinary pliability and its wonderful wearing qualities.

The quality of the wool varies somewhat with the climatic conditions under which the sheep live; cold climates produce a softer and better wool than warm climates, and therefore, high altitudes are especially favorable. It is claimed that the best wool in the world comes from the Provinces of Kahorasam and Kurdistan. The age of the sheep also enters into the quality of the wool; the younger the animal the softer and the more lustrous the wool.

In former times when the process of making Oriental rugs was stretched over a long period and the dyeing was done with natural dye-stuffs, rugs were produced with a beautiful surface gloss. At the present time this gloss is usually produced by the application of glycerine.

Dyeing

The washed wool is spun into strands and dyed in the skein by dipping it into pots which contain the dye solution. Then it is allowed to drain over the pot without wringing, after which it is placed in the sun to dry. It is usual practice to pass the yarn through a succession of pots, blending colors in this way rather than mixing them in a single pot. Many experts believe that this method of dyeing is responsible for the remarkable lasting qualities of the colors in antique Oriental carpets.

It is a characteristic of Oriental carpets to have bright elementary colors. The principal colors



FIGURE 5

Armenian weaver weaving small rug on home-made loom. The warp threads are tightened by driving wedges in the frame. The tools used by this young lady consisted of a pair of ordinary shears, a steel comb and a dull penknife, which she uses to assist in the manipulation of the thread. Skeins of yarn of different colors are hung to the upper part of the loom. For a pattern she is copying a finished rug which hangs from the top of the loom.

employed are red, blue, green, yellow, brown, salmon, gray, violet, purple and black. All these colors with the exception of black can be made from insects, flowers, roots and other organic materials.

The ancient Orientals had no satisfactory black dye. A dye which they made from iron filings treated with vinegar and pomegranate rind had the disadvantage of attacking the wool and gradually destroying it. In antique rugs the black portions that were made with this dye will be found to have practically disappeared from the pattern. In fact, the only black in antique rugs that resisted the action of time was that made with wool from black sheep. At the present time there is a satisfactory black vegetable dye which has no harmful effect on the wool; it is made from logwood, which comes from Central America.

For the purposes of the present book, it is not deemed necessary to attempt to give the methods of producing the various colors from organic substances, suffice it to say that all the colors above mentioned can be and are made from organic substances, and when so made are called natural dyes.

As was mentioned before, on account of the commercialization of rug making in the Orient, the practice of employing aniline and other chemical dyes has sprung up, and has become practically universal. By using chemical dyes of bright colors and then washing out the colors to get

softer shades and tones, the quality of the Oriental product has suffered great damage, and unless this practice is discontinued it will result in permanent injury to the Oriental rug industry.

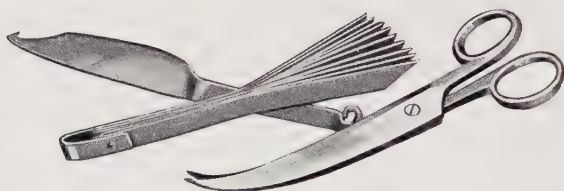


FIGURE 6

Steel tools used by Persian weavers. The hook is used for drawing threads through the warp. The comb is used for beating down the knots and the weft threads. Shears are used for clipping the pile.

The Persian Government believing that the chemical dyes were a menace to their carpet industry, passed drastic laws forbidding their importation and use. One of the penalties was the cutting off of the right hand of anyone caught using such dyes, and the seizing and destroying of all fabrics in which they were used. However, it must be admitted that the Persian Government has been lax in the enforcement of this law, as no considerable number of one-handed rug-makers has been reported.

One authority states that fully 75 per cent of the rugs produced in Asia Minor are dyed with aniline colors. In fact, much of the yarn used in Oriental carpets is spun and dyed in Europe, after which it is shipped to the Orient for weaving.

Doctoring

Among rug dealers and especially dealers in Oriental rugs there is a practice of doctoring the colors. Dyes are dissolved in alcohol and painted onto the rug with a brush. Sometimes this is done to correct inequalities and imperfections in the original coloring. Other times it is done to give the customer the exact color desired, but the purpose is always the same, namely: to deceive the purchaser. Color applied in this way is not permanent and usually can be detected by opening the pile. If the color is only on the ends, or near the ends of the pile, it has probably been painted on. However, this work is sometimes very skilfully done, the pile being opened and painted down as far as can be reached with a brush, so that its detection is rendered difficult unless one examines the pile very carefully.

How to Detect Aniline Dye

Oriental rug experts claim that aniline dyed carpet is harsher and drier to the touch than one dyed with natural materials. However, there is some difference of opinion on this point. It is true that aniline dyes in a rug can often be detected where a bright color comes next to a pure white. If there is any indication of the white having absorbed some of the color, the dye is

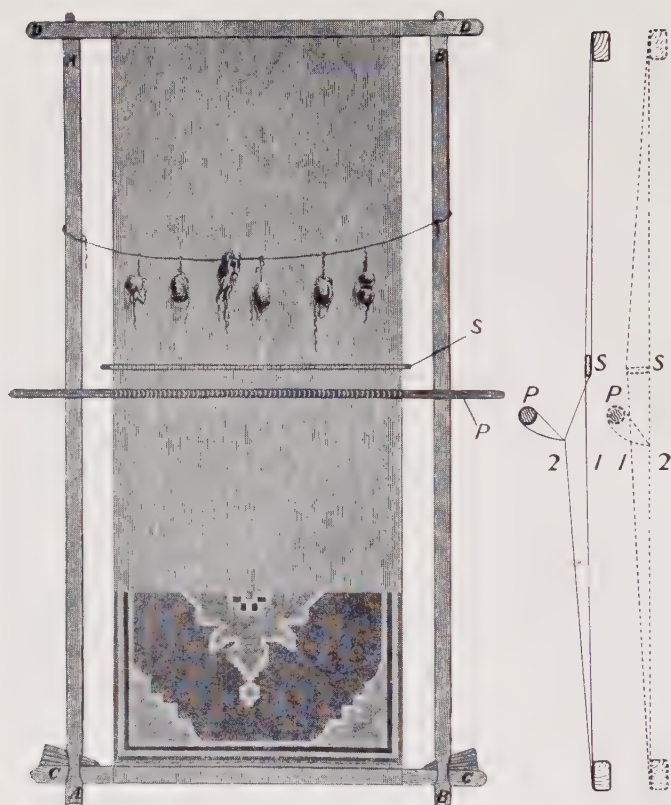


FIGURE 7

Vertical loom, which illustrates the principle of construction of certain types of Oriental looms. The frame is made up of the parts, A, B, C, D. The warp is stretched between the cross pieces C and D and tightened by means of the wedges at the bottom. The strip, S, passes through the warp threads, every other one being on the front side. The pole, P, is equipped with a number of loops equal to half the number of warp threads. These loops are attached to those threads which go across the back of the strip, S. When the strip, S, is thrown on its side as shown in the dotted end view, the warp threads are opened with 1 at the front and 2 at the back. When the strip, S, is in the upright position and the pole, P, is pulled forward, the warp threads are opened in the opposite direction as shown in the full-line drawing. The knots are tied to the warp threads and when a row has been completed the threads are opened by means of the strip, S, and the pole, P, to form a shed for a weft thread.

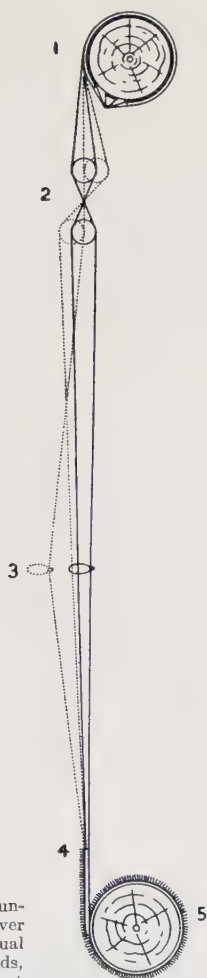


FIGURE 8

The Orientals invented hundreds of years ago a very clever method of maintaining equal tension on the warp threads, when the shed is opened first one way and then the other. The illustration shows the principle very plainly. 1, Beam on which the warp is wound. 2, Lease-rods which maintain equal tension. By examining the full and dotted lines, it will be seen that these rods automatically assume a position which takes up the slack in either one of the warp threads. 3, Loops by which the warp threads in the back layer are pulled forward. 4, Completed carpet. 5, Beam on which completed carpet is wound.

aniline. If there is no such indication, wetting the spot will often cause the color to run.

Some Oriental experts claim to be able to tell the difference between aniline and natural dyes by inspecting the carpet through amber beads. There are other experts who claim that this method is a fake intended to impress credulous or inexperienced buyers.

Rugs which have faded slightly present a method of distinguishing between aniline dyes and natural dyes that is available to anyone. A carpet fades on its outside surface first, leaving the pile at the base the original color. Therefore, by separating the pile and comparing the faded color with the original color, conclusions regarding the dye employed can be drawn. If the color at the base is entirely different than at the surface or ends of the pile, it is an aniline dyed carpet. If the colors are the same but of different shades, the chances are that it is a natural dyed carpet, although this is not positive proof unless the color examined is one that would be made up of two or more primary colors.

How to Detect Washing

The practice of washing Oriental carpets with chlorine solution is so prevalent that care should be exercised in purchasing Oriental rugs to check up this point. A rug that has been washed will reveal a different color at the base of the pile than

is exhibited on either surface. Sometimes the washing has been so thorough that it is practically necessary to pull a tuft out of the rug in order to discover the original color. As was mentioned before, a rug is sometimes entirely bleached out and re-dyed by painting with dyes dissolved in alcohol. In some cases it may be difficult to distinguish between a washed rug and a rug that has faded from natural causes, because the washing achieves the same result in a short time as would be obtained by fading through a period of years. The disadvantage of the washing is that it injures the fabric and shortens the life of the rug.

Colors

To a certain extent colors enter into the classification of Oriental carpets, because in earlier days, when each locality produced its own type of carpet, certain colors predominated in each locality, depending upon the tastes of the people, as well as upon their religious beliefs. For instance, green being a sacred color, was never used by the Turks because it would be sacrilegious to walk upon it.

Design

Originally it was possible to tell from the design in what part of the Orient a carpet was made, as each locality had its favorite designs and color combinations. One of the results of commercial-

izing the carpet industry was the dictation of the design by the rug dealers, rather than by the rug makers. Consequently, the design of a modern Oriental rug is no longer a reliable indication of its origin.

As far as antique Oriental rugs are concerned, the study of design and coloring is of the greatest importance to anyone who wishes to become a judge of such fabrics. There is a comparatively small number of fundamental figures that were employed in the design of Oriental rugs, but the combinations of these elements are practically unlimited, since each individual rug maker followed his own ideas to a certain extent.

The subject of design is much too deep and intricate to be covered in the present book. Various excellent books have been written on the classification of Oriental rugs. Those who are anxious to pursue the study of Oriental rugs with the idea of being able to distinguish one type from another, will find an unusually complete classification and analysis of designs in "The Practical Book of Oriental Rugs," by G. Griffin Lewis.

Although we cannot go into detail, there are a few general principles of design that can be easily learned and may be of some interest and value. For instance, Persian and Kurdish rugs are usually woven with a floral design, although animals are also used to a considerable extent. Turkish rugs usually contain a mixture of floral and geometrical figures, the flowers being much more

angular and conventional in design than those used in Persian rugs.

The Turks, being most orthodox among the Mohammedans, follow the dictates of the Koran. They never weave figures of animals, birds or human beings into their rugs, as the Koran forbids the reproduction of such likenesses, fearing it will lead to idolatry. They also never make their de-

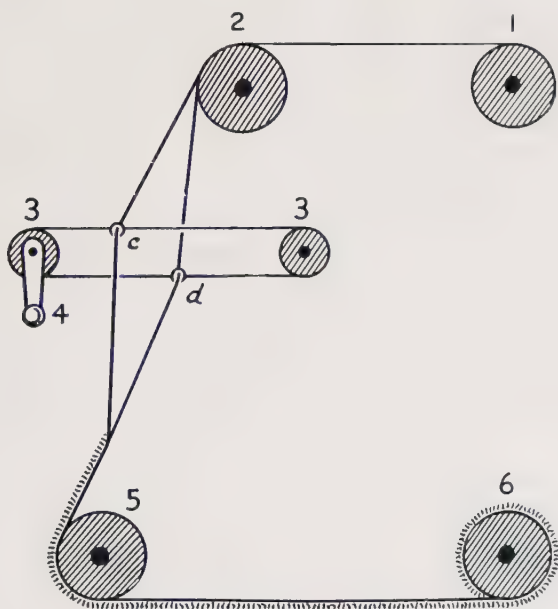


FIGURE 9

A type of Oriental loom used in Europe. 1, Warp beam. 2, Guide roller for warp threads. 3, Rollers which carry loops that open the warp threads first in one direction and then in the other as the crank, 4, is turned. 5, Guide roller for completed carpet. 6, Beam on which completed carpet is wound.

Each warp thread passes through a ring *c* or *d*. When the *c* rings are pulled forward, *d* rings are pulled backward by an equal amount, thus the matter of equal tension is automatically taken care of.

sign symmetrical, as otherwise the rug would be perfect, and only Allah can be perfect. Caucasian and Turkoman rugs are practically all woven with geometrical figures, although flowers are used sometimes and when used they are made up entirely of straight lines. The Chinese use dragons, monsters and animals of all sorts in their rugs.

The designs from which the rugs are woven are prepared in various ways. Many times a completed rug is merely copied, other times sections of rugs are specially woven for the purpose of serving as pattern to the weavers. In some localities there exists a conventional method of sketching the design, using signs to represent different elements of the design. In still other cases an actual sketch of the pattern is made. Many establishments do not furnish designs to the weavers but delegate the task to one of the workers of singing the design, so that all the weavers on a given carpet can follow.

Weaving

The process of weaving an Oriental carpet is extremely simple as far as the mechanical operation is concerned, but requires skill and great patience to perform. The monotony of the operation is such that the strain of weaving is beyond the endurance of any people except the Oriental. Only they seem to be capable of sitting day after day and tying the same knot over and over again.

An idea of the tediousness of the work may be obtained, when it is considered that a small rug may have as many as a million knots in its structure.

The Oriental weaver requires very little equipment. He sets up the main body of the fabric by stretching threads over a frame called a "loom." These threads form what is known as the warp. To hold the warp threads together, other threads are passed across the warp threads under one and over the next, forming what are known as the weft threads of the rug. The face of the rug is composed of the loose ends of knots that are tied one at a time to the warp. The weft threads are inserted as the weaving progresses, there being alternate rows of knots and wefts. Each row of knots is beaten into place by means of a steel comb and the ends clipped with a pair of shears. These are the only tools required by the weaver, although a peculiar shaped hook is sometimes used to pull threads through the warp.

Loom

The Oriental loom has not changed in thousands of years. In principle they are all the same, but in actual construction there are certain differences. First, there are two general types, one in which the frame is in a vertical position and the other in which the frame is in a horizontal position. Each of these types is in turn divided in

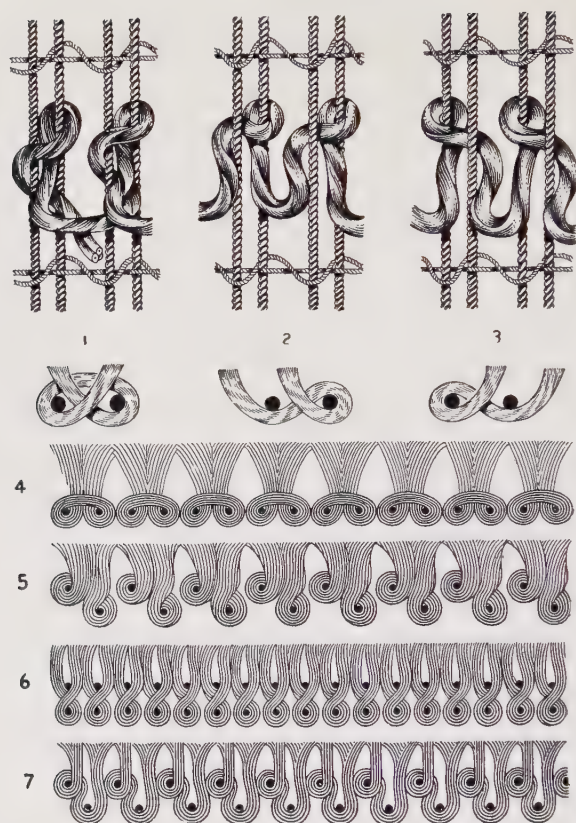


FIGURE 10.—ORIENTAL KNOTS

1, Method of tying Turkish or Ghiordes knot. It will be noted that the upstanding tuft ends are between the warp threads, and when looking at the fabric we have in any given row two pile ends, two warp threads, two pile ends, etc. 2, Method of tying left-hand Persian or Senna knot. It will be noted in this knot that the pile ends and warp ends alternate. In other words, there is an upstanding pile end between each pair of warp ends. 3, Method of tying right-hand Persian or Senna knot. 4, Series of Turkish knots with warp threads in one plane. 5, Series of Turkish knots with alternate warp threads thrown to the back. 6, Persian knot with alternate warp threads thrown clear to the back. For instance, if the knot shown in 2 has its right-hand warp thread pushed downward until it is immediately below the other warp thread, the knot will become the same as shown in 6. 7, Right-hand Persian knot with alternate warp threads thrown to the back. This knot is made by tying as in 3 and then throwing the right-hand warp thread to the back.

two, one in which the warp is stationary and the weavers move, and the other in which the weavers are stationary and the warp moves.

In Figure 4 is shown a stationary frame of the vertical type. The weavers are seated in front of the loom on a long plank which is supported by the rungs of two ladders. As the weaving progresses the seat is moved up the ladders. In this type of loom, the warp threads are tightened by means of wedges inserted in the bottom beam. The method is shown in Figure 7.

A vertical loom arrangement for moving the fabric in front of the weaver is shown in Figures 1, 2 and 3, which are reproduced from an article by Duhamel du Monceau and published in the proceedings of the Academie Royale des Sciences, 1766. These illustrations show plainly how the carpet is rolled onto the lower beam as the work progresses. Horizontal looms operate in exactly the same way, except that where stationary frames are employed it is usual for the weavers to sit on the completed part of the rug.

Each weaver usually works on a width of approximately 27 inches, and the average day's work consists of 8 or 10 inches of this width.

The separation, or shedding, of the warp threads, so as to shoot the weft across, is usually accomplished by means of a pole extending across the front and a flat strip which passes between the warp threads. Figure 7 shows the arrangement of these two parts. The pole P, is equipped

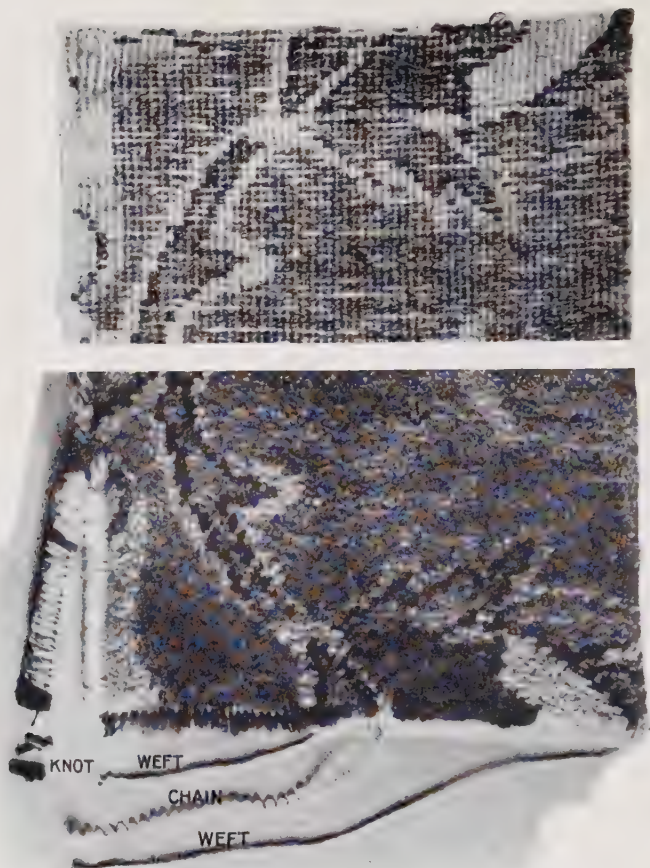


FIGURE 11

Persian carpet woven with Persian knot of the type shown in, (7) Figure 10. This rug is made with cotton warp and weft. The weft consists of two shots of cotton running straight through and separating the warp threads into two layers. Between these is a third weft thread or chain, which consists of five very fine cotton threads, binding the warp threads together by drawing them from the top and the bottom against the two straight weft threads. This particular carpet has a pitch of fifteen and a beat-up of fifteen. Therefore, it has 225 knots or tufts per square inch. The knot is shown in Figure 11, Plate I.

with a series of loops, one for every other warp thread. A flat strip S, is inserted between the threads of the warp in such a way that those which pass through the loops in the pole P, pass behind the strip S. The sketch in Figure 7 shows the theory somewhat better than can be seen in the illustrations of the complete loom.

In Figure 8 is shown a cross-section through an Oriental loom, which illustrates clearly the method used in many cases to maintain an even tension on the warp threads when one group is pulled forward. This is accomplished by the two rods near the top which are swung from the upper warp beam. When one group of threads is pulled forward as shown by the dotted lines, these poles are pulled forward in such position as to stretch the back threads and release the front threads by an equal amount, thus equalizing the tension of both groups.

In Figure 9 a modern European loom for Oriental weaving is shown. Here the warp is wound on the beam 1, and passes over the drums 2 and 5, the completed carpet being wound up on the beam 6. Each warp thread passes through a small ring, c and d representing two rings. These rings are carried on endless belts supported by the rollers 3.

Turning the crank 4 forward, pulls every other warp thread passing through the rings c, to the front. Pulling the crank backward brings the threads passing through the rings d, to the front.

In this way the warp can be separated first in one direction and then in the other, merely by swinging the crank backward and forward.

Weaving Knots

The operation of tying the pile into the warp is an extremely simple one, and as far as can be learned has not changed since prehistoric times. There are only two fundamental types of knots used for this purpose, namely: the Turkish or Ghiordes knot, and the Persian or Senna (also spelled Sehna) knot.

The Turkish knot is made as shown in Figure 10. As will be seen, two loose ends project between adjacent warp threads and two warp threads are included between adjacent pile ends. In the Persian knot, the pile ends and warp threads alternate. Therefore, the Persian knot gives a more uniform distribution of the pile than the Turkish knot, and consequently permits a tighter weave and a shorter pile.

The Turkish knot, in order to make up for the slight difference of uniformity in distribution, requires that the pile be cut longer. Both these knots are used throughout the Orient at the present time.

It is not always easy to distinguish the type of knot by finding whether the pile ends and warp threads alternate, because every other warp thread

is sometimes thrown to the back as shown in Figure 10 (5) and (7). However, if the front and back are examined very carefully, it is not difficult to distinguish between the Turkish and Persian knots. The illustrations herewith are self-explanatory on this point.

The Persian knot can be made either left-hand or right-hand as shown in Figure 10 (2) and (3), while the Turkish knot is always symmetrical. Consequently, a rug made with a Turkish knot has its pile lying in one direction, namely: toward one end of the warp; while the Persian knot produces a pile that lies toward the left-hand corner or the right-hand corner when looking at the pile end on, depending upon whether the knot is a left-hand or a right-hand knot. Therefore, the direction of the pile is a simple indication of the type of knot used.

A rug that has been washed may mislead anyone examining the direction of the pile, as in such cases the pile will lie in which ever direction it was brushed when washing. In fact, it is a sure sign that a rug has been washed if the pile lay is crossways of the warp instead of toward one end.

The Turkish knot is used in all rugs of Asia Minor, Caucasia, some in India and extensively in Persia, while the Persian knot is used in Turkoman and Chinese, in many Persian and in some Indian; most are right hand. The Persian knot permits closer weaving and cleaner definition of the pattern on account of the shorter pile.

CHAPTER IV

EUROPEAN HAND-TUFTED CARPETS

In the various countries of Europe a great deal of hand-made carpet is still produced. Most of this work is in the form of moderate size rugs, although there are various establishments that weave to order large rugs of very high quality. As far as materials and dyeing are concerned, these hand-made products have no fundamental advantage over machine-made rugs, but from the standpoint of weaving they have some important advantages. First, there is no limit as to the design and color, except the artistic skill of the designer and the weaver. It is also a fact that where single pieces of individual design are to be made, it is just about as cheap to make them by hand weaving as it is to prepare for machine weaving, as the main advantage and saving in machine weaving is derived only by reproduction of the same pattern a large number of times. Then, too, in hand weaving the tufts are tied in more firmly than can be done by machine.

The most famous of the foreign hand-woven carpets are the types originated in France, Aubusson and Savonnerie.

The Aubusson carpet is in reality a Tapestry and is seldom used as a floor covering. The face of the Tapestry is made of woolen weft, being inserted with very small shuttles. In the Edgewater looms, Edgewater, New Jersey, this type of

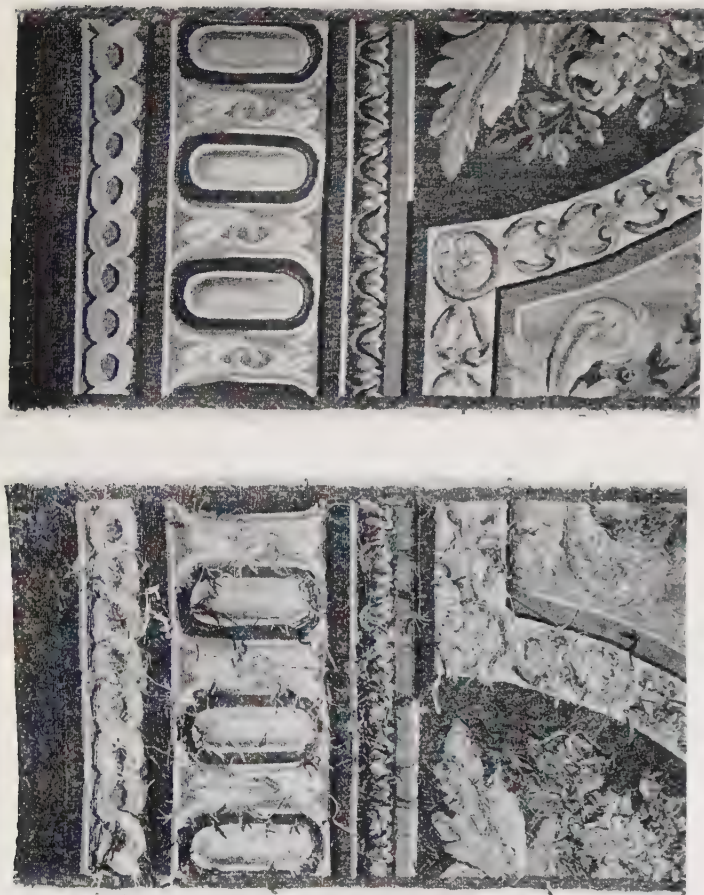


FIGURE 12

Aubusson Tapestry. This tapestry is woven with the wrong side toward the weaver. There is no pile on the surface. The colors are unlimited, because the wool is woven in from very short bobbins, and when a color patch is complete the end is cut off and left loose unless there is another patch of the same color in close proximity. The back view which is shown at the bottom shows plainly the loose ends of the wool.



FIGURE 13

A sample of Savonnerie Hand-Tufted Carpet. The front view is shown at the top, the back view at the bottom. In this particular sample the pile is made of fine worsted, the beat-up is six and the pitch seven, making the number of points 42. The surface of the carpet, however, is very thick, as the pile is $\frac{1}{2}$ inch high and the worsted yarn is eight-ply. This sample is a modern product, although it is woven in the same way as the original Savonnerie carpets which were developed at Chaillot in the early part of the seventeenth century.

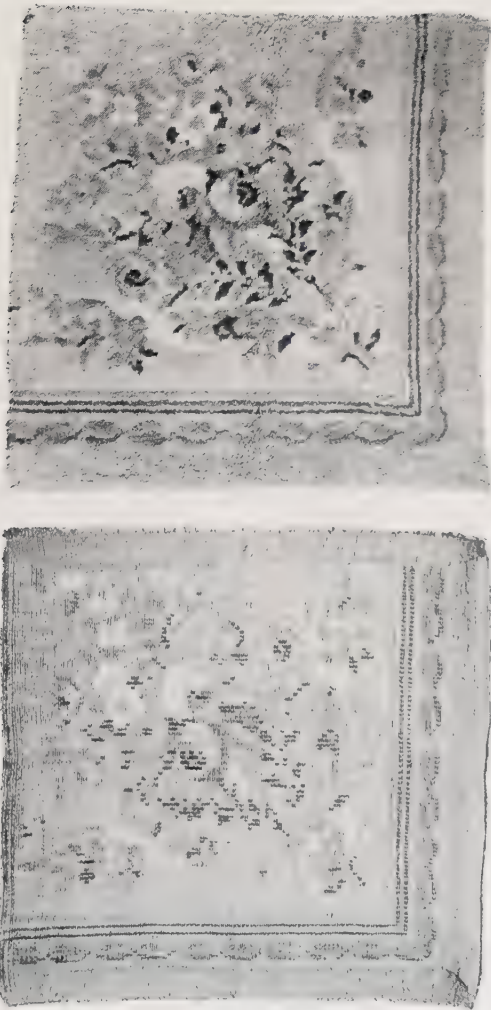


FIGURE 14

Spanish Hand-Tufted Carpet. This carpet has exceedingly deep pile and is woven with a Turkish knot. The woolen yarn which is spun by the natives has a very sharp twist. The trimming is done in such a way so as to give a sort of bas-relief effect.

Tapestry is produced by stretching the warp threads directly over a cartoon, which is a full-size reproduction of the pattern in true colors. The weaver then covers this cartoon, exactly matching the colors and the design. The back of the fabric is toward the weaver. When a patch of color is completed the loose end of wool is broken off unless the same color is used again in the same portion of the fabric. Figure 13 shows a front and rear view of a piece of Aubusson Tapestry.

Savonnerie carpets are hand-tufted, using woolen yarn and a Turkish knot. A front and back view of a sample of this type of carpet is shown in Figure 12. The pile is usually left fairly long and therefore this carpet is more difficult to clean than the average Oriental or the various machine-made carpets.

Both the Aubusson and the Savonnerie carpets are extremely expensive. At the present time the prices range from approximately \$140 to \$260 a square yard for Savonnerie, and from \$180 to \$345 a square yard for Aubusson.

In Figure 14 is shown a sample of Spanish hand-tufted. This particular sample is made with a Turkish knot and extremely long pile of sharply twisted worsted yarn. It is unusually reasonable in price, because it is made by simple natives who raise their own sheep and spin their own yarn. Like most other hand-made carpets it can be purchased only on special orders.

MANUFACTURE OF CARPETS

The processes of making the various machine-made carpets have so much in common that it seems wise to consider the process of carpet making in general before taking up the individual types. In this way a proper perspective of the process can be obtained and much repetition avoided. Then too, it has the advantage of permitting a discussion of each individual type of carpet in which stress is laid only on those points wherein that type differs from others.

In general the process of carpet making is divided into four groups of operations.

1. Choice of materials and their preparation for weaving.
2. Dyeing of materials for weaving.
3. Making of designs and preparing them for use by the weavers.
4. Weaving of the fabric.

Materials

Machine-made carpets differ considerably in structure from the Oriental and among themselves may be divided into several distinct types. However, all machine-made carpets have warp, weft and pile, in which respect they are similar to the Oriental carpets. In addition to these three ele-

ments machine-made carpets often have material inserted to increase the bulk or to stiffen the structure. Such threads are known as stuffers, fillers or floats. Sometimes they are inserted as warp and sometimes as weft, depending upon the type of carpet. The warp threads always run lengthwise of the carpet or rug, the weft threads run across. The pile may be attached to either the warp or weft, depending upon the type of the carpet; the stuffers, fillers or floats may run either lengthwise or crosswise of the carpet depending upon the type.



FIGURE 15

Scotch Fleece just as it comes from the back of the sheep. It is held together by the intertwining of the fibers.

The materials used in a carpet are determined by the functions they are to perform in the structure. Some are chosen for stiffness and bulk, others for strength, others for flexibility, others for appearance, and still others for resistance to wear. Almost without exception, wool is used for the pile, cotton for the warp, jute for the weft. Both jute and cotton are used for fillers, linen is sometimes used for the weft.

In American-made carpets the percentage of wool is approximately 44, jute 35, cotton 16, linen 4, and all others 1 per cent. These figures are only approximate, but they represent fairly closely present-day practice.

Preparation of Wool

Wool is such an important factor in the manufacture of a carpet, that many carpet mills buy their wool in the fleece and perform all the operations necessary to convert it into suitable weaving material in their own plant. Therefore, it is proper to consider preparation of the wool as one of the important stages in the making of a carpet.

It is beyond the scope of this book to describe the actual processes, but it seems worth while to mention the various stages through which the wool passes merely to give an idea of the amount of labor involved.

The quality of wool used in the manufacture of carpets determines the quality of the carpet. The



FIGURE 16

At the left is shown a piece of Scotch Fleece scoured, and at the right a piece of China Wool scoured. The Scotch Fleece has a long fiber and is rather coarse, but possesses great strength and resiliency. The China Wool is soft and fine. The former gives wearing qualities and the latter spinning qualities.

best carpets are made of long fibered fine wool, which is first thoroughly washed to remove all animal fat and foreign substances. It is then carded and combed in a series of machines for the purpose of straightening out the fibers, and laying them in one direction, at the same time removing the short fibers. After the wool has been combed into long strips which resemble feather boas, it is drawn into long strands and spun into threads which are then twisted into yarn.

Wool yarn is usually made of shorter fibers, which are closely intermingled and spun into threads of comparatively large diameter.

The finest long fiber wool, when spun tightly and with the fibers laying fairly straight, is called "*worsted yarn.*"



FIGURE 17

At the left is shown a small quantity of blended wool which has been oiled ready for carding. The second specimen is a sliver of carded wool which has been passed through the carding machine, that lays the fibers in approximately parallel directions. However, they are still considerably intertwined, as may be seen by examining the sliver near the ends. The third specimen is combed wool. In this process the fibers are laid practically parallel, because they are all passed through fine combs. This process also removes the short and broken fibers, which are known as noils, and are later used in making woolen yarns. A great deal of this short fiber is employed in the manufacture of certain grades of Axminsters. The noils are shown at the extreme right of this picture.

The principal steps in transforming raw wool into worsted yarn are shown by the series of photographs in Figures 15 to 19. The captions explain the various operations involved.

Carpets having long pile and coarse weave usually employ wool yarn for the pile, while those which have short pile and fine weave are made with worsted yarn. Wilton, Brussels, Tapestry and Velvet carpets are usually made with worsted; while Chenille and Axminster carpets and many hand-tufted carpets are made with woolen yarn. These are not hard-and-fast rules, because worsted is often used in Chenille and Axminster carpets, and woolen yarn is sometimes used in Wilton carpets.

Dyeing

The use of natural dyes such as were employed in ancient times has practically disappeared from the carpet industry, these dyes having been supplanted by chemical dyes made for the most part by the distillation of coal tar. The first coal tar dyes to be developed were known as "Aniline" dyes. Later a group of dyes made from by-products of the aniline process and known as "Alizarine" dyes were developed. The latter are specially important to the carpet industry, as they are exceptionally effective in the dyeing of wool.

The dye industry has been greatly developed in recent years and there are now many colors made by chemical processes which are absolutely fast



FIGURE 18

The combed wool is drawn in a number of successive operations preliminary to spinning. The process of drawing consists in subjecting the wool to a pull which slips the fibers along, producing a strand of smaller diameter and greater length. This illustration shows successive reductions in size due to drawing. The wool after it has passed all the drawing operations is in the form of a fat yarn called a roving.

under all conditions. However, some of the chemical dyes fade badly and some of them run when washed. In fact, aniline dye can often be detected by the running of the color in parts of the design where a dark color comes next to a light one.

It must be admitted, so far as chemical dyes are concerned, that whether it is due to the dyes themselves or the processes used by the dyers, the

results are many times not as satisfactory, from the standpoint of fastness and variety of colors, as the old vegetable dyes.

In this connection, it is interesting to note that ancient methods of dyeing are used today in this country, to a limited extent, by makers of the finest woven wall and furniture tapestries. The



FIGURE 19

The roving, which is wool from the last stage of drawing, is drawn still further and twisted to prevent breaking; a process called *spinning*. A spun thread is shown at the left. To make a stronger thread, two spun threads are twisted together as shown in the middle; this process is called *doubling*. The sample at the right is the finished worsted six-ply yarn made by twisting three-doubled (or two-ply) strands together.

reason they insist on using dyes made of vegetable and animal matter is that they find it impossible to obtain chemically dyed wool that is sufficiently fast and accurate in color value to permit its use in the finest and most expensive fabrics.

In the manufactured carpets coloring is produced in various ways. In some the wool is dyed in the skein; in others the wool is dyed according to definite pattern in such a way that when inserted into the weaving machine, the color required for the pattern will occur at exactly the proper place. In still other carpets the whole carpet is woven of one color and the pattern or design printed on the surface after it is finished. In fact, the last two methods are more accurately described as printing than dyeing.

Design and Coloring

The unique feature in carpet design is the limi-

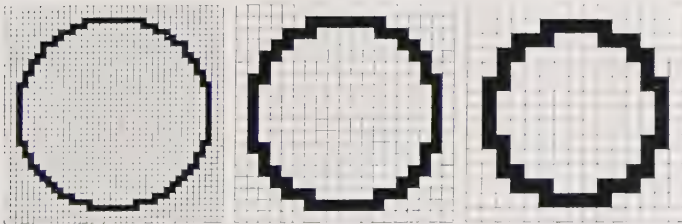


FIGURE 20

The number of knots or tufts per square inch in the structure of a fabric influences the type of design that can be used. The smaller the units of which the design is composed, the greater the possibilities for detail. In the above illustration the circle is produced in units of different size. It will be seen that in the finest weave a very close approximation to a circle is obtained; while in the coarsest weave the circle becomes almost a square.

tation imposed by the construction of the carpet itself. Generally speaking, the design must be composed of units of uniform size, each unit representing a loop or tuft of the carpet surface. Therefore, the first limitation in the perfection of the line and shading used in a design is the number of units available per square inch. The larger the number of knots or tufts per square inch, the finer may be the lines and color gradations.

Figure 20 illustrates the effect of the number of tufts, loops or points in the carpet weave upon the smoothness of contour. The greater the number of points per square inch the better is the weave adapted to curved lines and designs of fine detail. Coarser weaves require designs of a rectangular character.

In many cases the number of colors that can be used in a design is limited by the process of weaving. For instance, body Brussels and Wilton, due to mechanical reasons, are limited to five or six colors, except in special cases, where extra colors can be substituted for one of the five or six used in other parts of the rug. The use of colors in this limited way is called "planting" and is illustrated and explained in Figure 33 on Plate II.

The method of weaving imposes certain limits on pattern and coloring. These limitations are discussed under the various kinds of carpets.

The design of a carpet is usually laid out on cross-section paper which is divided into rectangles, each rectangle representing a tuft in the

face of the carpet. In hand weaving these papers are read directly by the weaver. In machine weaving they are handled in various ways. The design shown in Figure 21, Plate I, would be read by a hand weaver one tuft at a time in rows across the design.

In all machine-made carpets the colors are set up one row at a time, although some processes set up the horizontal rows and others the vertical. This subject will be treated under each individual type of carpet.

The cross-section paper on which the design is laid out for the weavers is called the design paper, and many times the word "paper" is used synonymously with square inch. For instance, a 7 x 12 paper means that in a square inch there are seven loops or tufts of pile per inch of width and twelve per inch of length; that is, 84 loops, tufts or points per square inch. More will be said of these subjects in connection with the processes to be described later on.

In order to present an actual example, the design shown in Figure 21, Plate I, was laid out on cross-section and the ways this design would be handled for the various types of carpet are set forth in the caption.

Weaving

The weaving of a carpet is a purely mechanical operation. It is the only one of the four factors above mentioned that has been improved in

modern times. As far as Oriental weaving is concerned there has been absolutely no change for hundreds of years, but the machine-made carpet has been continually improved.

In order to follow the description of weaving in connection with the various types of carpets, it is



FIGURE 22

Flop-over Pattern. In many machine-made carpets the cost of production depends upon the size of the design. Many times a design may be made to appear twice as large as it really is by making the whole design symmetrical about a center line. In this way the weaving progresses from the outside to the center of the pattern, and then retraces the steps back to the outer edge. It is the number of steps that count, and in this case by reversing the order in which the steps are taken, with a given number of steps, the size of the pattern is doubled. A pattern such as shown in Figure 70 cannot be handled in this way and therefore requires twice as many steps as a pattern of the same dimensions which is symmetrical about its horizontal center line.

necessary to understand the fundamental principles of weaving. This can best be done by considering the simplest form of loom, which is virtually the type used by the Orientals.

A working model of such a loom may be constructed with a simple wooden frame, a piece of cardboard and a knitting needle as shown in Figure 23. Wooden pins are mounted in holes drilled in upright pieces mounted on a piece of board and threads are stretched across the rods 1 and 2 at uniform intervals. A piece of cardboard 3, is prepared with a series of parallel slots and between each pair of slots a hole. The total number of slots and holes is exactly the same as the number of threads stretched across the rods; every other thread passes through a hole—the alternate threads going through the slots. The knitting needle has a quantity of thread wound on it and is used for carrying this thread between the longitudinal threads when they are separated by the piece of cardboard. When the cardboard is depressed, half of the threads are carried down by the holes, the rest of them remaining at the top as the slot permits the card to move downward without interfering with them. This opening of the threads by depressing the cardboard makes a place through which the knitting needle can be passed, the needle going over one thread and under the next. When the needle is pulled through, its own thread is left behind it and should be pushed over to one end by means of

a comb. The cardboard is next pulled toward the top causing the longitudinal threads to be separated again but in the opposite direction. Those

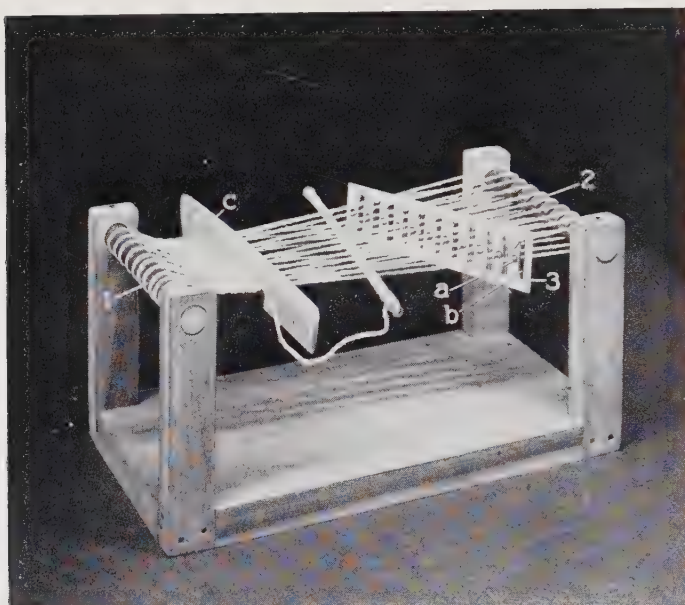


FIGURE 23

The principles of weaving with a loom may be illustrated by a home-made model such as here shown. Two wooden pins, 1 and 2, serving as warp beams are set up in a frame. A piece of cardboard, 3, provided with alternate slots, *b*, and holes, *a*, serves as a heddle. Now the loom is set up by stringing warp threads from beam, 1, to beam, 2, passing them through the heddle, every other thread passing through holes, *a*, and intermediate threads through slots, *b*. The heddle, 3, serves to open the warp threads so that another thread, *weft*, can be passed across, going over one and under the next. The weft thread is wound on a knitting needle that serves as a shuttle, to carry the weft across from side to side. The opening in the warp threads produced by raising or lowering the heddle is called the *shed*. The shuttle passes through the shed. The weft after being dragged through the warp by the shuttle is pressed, *beaten up*, against the preceding weft threads by a comb, *c*, called a *reed*, each opening in the reed is called a *dent*.

threads which were at the bottom are now at the top. The needle is then passed back and the trailing thread pushed over to the left with a comb until it is tight against the thread that was inserted the previous time across. By alternately lowering and lifting the cardboard, passing the needle across each time, a plain basket weave such as shown in the photograph is produced.

To translate these various items into weaving terms: The wooden pins 1 and 2 represent the warp beams; the longitudinal threads stretched between them represent the warp; the cardboard 3 represents the heddle; the knitting needle represents the shuttle. The thread on the knitting needle which is woven backward and forward is the weft. The space that is made by the heddle for the shuttle to pass through is called the "shed".

The warp and weft form the body structure of the carpet. Sometimes extra threads are laid lengthwise and crosswise of the carpet which do not add to the strength, but simply increase the bulk, weight and stiffness. Such threads are called "stuffers" or "fillers." The face of the carpet which is called the "pile" is attached to the warp and weft in various ways, depending upon the type of carpet. The exact method of attaching the pile and laying in the filling material is discussed in connection with the descriptions of the various types of carpets, each of which is treated in a separate chapter.

Finishing

The woven carpet is steamed and dried to straighten the pile and make it stand upright, after which it is passed through a machine which shears it to an even height. The blades of this machine cut on the same principle as the lawn mower. The carpet is then examined carefully and all imperfections removed by hand. Before going out, it is thoroughly cleaned so as to remove as much of the dead pile as possible. Some of the manufacturers of the finest cut-pile carpets use Hoover Suction Sweepers to remove this dead pile. If the dead pile is not removed it often leads the purchaser to think that this carpet is falling to pieces.

CHAPTER VI

BRUSSELS CARPET

The Brussels carpet involves the same principles of weaving as are used in the Wilton, the Tapestry and the Velvet, all of which were developed after the Brussels. In all of these carpets the pile is formed by looping worsted or woolen threads over wires that are stretched in the loom at right angles to the warp. The way these threads are manipulated is shown by a simple diagram in Figure 24, Plate I. There are three classes of threads stretched lengthwise of the Brussels loom. The warp proper, called the "chain", is lettered C. These warp threads are made of cotton and are woven up and down over the weft threads, binding the fabric together. The second type of warp thread is the filler, F, a cotton thread which goes straight through between the weft threads. It simply adds to the bulk and stiffness of the fabric and takes the strain produced by the chain in pulling the weft threads together. The third class of warp is a series of woolen threads, there being one for each color employed in the pattern. These threads are manipulated in such a way that the proper color is brought up at each point and looped over a wire which is later withdrawn, leaving the loop.

Loom

The power loom is a complicated piece of mechanism. It would serve no useful purpose to go into the details of its construction. However, it may be of interest and it certainly should be of assistance in studying carpet structures to understand how the threads are manipulated. The essential elements of a Brussels loom are shown in Figure 24, Plate I. The warp threads are set up in the same way as in a hand loom, except that provision is made for moving them automatically forward as the weaving proceeds. In the power loom the comb is known as the reed, R. It is set permanently with the warp threads passing between its teeth. Each opening in the reed is called a "dent". Figure 24, Plate I, shows the number of threads that pass through each dent or opening in the reed. There are as many sets of threads in the loom as there are dents in the reed.

The worsted threads which form the pile each pass through a little ivory ring, which is suspended from a board, J, called a "comber board", and held straight by a weight hanging on the lower end. The chain warp threads, as well as the filler threads pass through rings carried by frames called "healds", H_1 , H_2 and H_3 . The healds perform the same operation as the piece of cardboard described in connection with the elementary loom on page 60. In operation the warp of the loom is fed from several sources and is wound up on a single beam as a completed carpet. The

chain warp, C, comes from a large wooden roller called a "beam". The filler, F, comes from a similar beam. The worsted warp which forms the pile comes from a series of spools, there being one spool for each color.

The operation, referring to Figure 24, Plate I, is as follows: Heald H_1 , is raised, H_2 is lowered, making a shed through which a weft thread is passed. A weft thread is passing through the shed. It is shown as a dot just in front of the reed, R. At the same moment one of the cords raises a worsted thread of the proper color (blue), and while this thread is up the wire W, is shot across in the upper shed. This is the position which the sketch shows. The next operation is for the reed, R, to move to the left forcing the weft thread and the wire, tight against the completed carpet at the left. Now the cord carrying the blue thread descends. H_2 raises and H_1 lowers, making a chain warp shed above the body of the warp. A weft thread is shot across and the reed moves to the left, binding the loop of blue worsted which had just been formed over the wire. From here on the weaving proceeds in exactly the same manner as described, each time the proper color being raised to form the pattern.

The mechanism which selects the proper color is known as a "Jacquard attachment". Its operation is controlled by a perforated record which resembles very much the record that is used for player pianos.

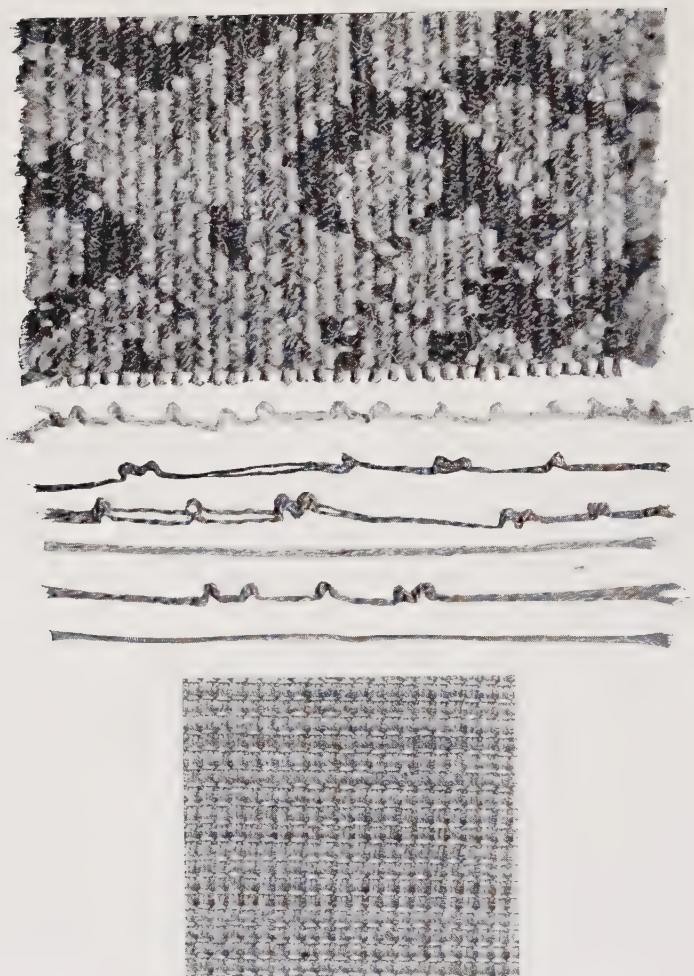


FIGURE 27

First-grade Brussels showing top view, back view, and the pile threads for one dent removed and separated. This carpet has five frames, two shots of weft per wire, nine wires and a pitch of nine, giving 81 points. The pile loops are worsted 3-32nds inch high. The chain is made of cotton, the weft of linen and the stuffer of jute

Frames

The carpet salesman employs a limited number of technical terms which can be easily explained by reference to the Brussels loom shown in Figure 24, Plate I. For instance, a Brussels or a Wilton carpet is said to have a certain number of frames. By frames is meant the number of worsted pile threads which pass through each dent of the reed. In this case a three-frame set-up is shown. Ordinarily, a carpet has as many frames as colors but not always.

Sometimes a pattern is worked out in such a way that the color set-up can be changed in certain portions by substituting one color for another. For instance, in Figure 33, Plate II, a sample is shown where bright green has been substituted for blue at regular intervals across the carpet. This substitution of color is called "planting". It can be detected by following a color lengthwise of the rug and counting the number of colors that appear in that line.

Referring to Figure 24, Plate I, which is a three-frame set-up, if for every sixth dent green is substituted for red, we would have a carpet with four colors in it and yet the number of frames would still be three. The number of frames is a measure of the amount of worsted in the carpet.

Wires and Pitch

The loops of Brussels carpet are formed over



FIGURE 28

Enlarged cross-section through the carpet shown in Figure 27. The section is cut close to the chain and shows plainly the chain and the weft threads.



FIGURE 29

Enlarged cross-section, same as Figure 28, except that the chain has been removed and the ends of the weft threads clipped back, so as to show the pile threads that are bound between the weft threads.

wires and the number of wires per inch is a measure of the number of loops. Therefore, a nine-wire carpet is one that has nine loops per inch of length. The number of loops per inch width of carpet is denoted as the “pitch”. Usually the pitch is given as the total number of loops in a standard width of 27 inches.

A loop of pile is often denoted as a “point” and the number of points per square inch is equal to the number of wires times the pitch (per in.).

Shots

In the formation of a loop of pile the weft thread is shot across the carpet a certain number

of times. If it is shot across twice for every loop, the carpet is called a "two shot", if three times a "three shot", etc. Figure 25, Plate I, shows a two-shot, three-frame Brussels carpet with two fillers or stuffers. Most Brussels carpets are two-shot weaves.

Special Shapes

The Jacquard mechanism has recently been used for producing carpets of special shapes. It follows as a matter of course that the Jacquard mechanism can pick up threads according to a figure design, in exactly the same way as it picks them up in accordance with a color design. For instance, it is possible to make a carpet by means of a Jacquard attachment that will have an oval shape or any irregular shape. Naturally, the body of the carpet will be rectangular, but the pile can be any shape desired, and when finished, the body can be cut to conform to the design on the face and the edges bound under to prevent unraveling.

Quality

Aside from the materials employed, the quality of a Brussels carpet is determined by the number of frames which correspond to the amount of wool used in the pile, and usually also corresponds to the number of colors used in the pattern.

A further indication of the quality of the carpet is given by the closeness of the weave. The num-

ber of loops per inch of width (the pitch) is determined by the number of dents or openings in the reed, R, Figure 24, Plate I, while the number of loops per inch of length is determined by the number of wires per inch. The standard width of carpet is 27 inches and the best grades seldom have more than 256 threads in the width, which gives a pitch of practically nine or ten loops per inch of width. Likewise, the maximum number of wires per inch of length is usually nine or ten, although some of the best go as high as thirteen.

A high-grade Brussels will have a pitch of nine or ten loops per inch of width and nine wires per inch of length. Anything below nine wires is a second-grade carpet and anything below eight wires is a third-grade. The second-grade Brussels contains between eight and nine loops per inch of width; while the third-grade contains between seven and eight loops per inch of width.

CHAPTER VII

WILTON CARPET

The Wilton carpet is a logical development from the Brussels. Generally speaking, it is the same as the Brussels except that the loops are cut. The cutting of the loops is performed by using wires which are provided with a knife edge at the outer end, so that when the wires are withdrawn they cut open the loops as they pass through.

The Wilton carpet is woven in exactly the same way as a Brussels and is set up in the same way. Figure 30, Plate I, shows a five-frame two-shot Wilton with two fillers. Comparing this with Figure 26, Plate I, it will be seen that the weaving is exactly the same except that the loops are cut.

Most Wilton carpets use more than two shots of weft per row of tufts, because the cutting of the loops except in a very closely woven carpet requires a stronger binding to prevent the pile loops from being pulled out of the carpet. A three-shot Wilton is shown in Figure 31, Plate II. Two shots of weft are placed across the top between each row of loops. In this way the wool is held more firmly than is possible with only one shot. The two shots on top can easily be detected by opening the pile as shown in Figure 74.

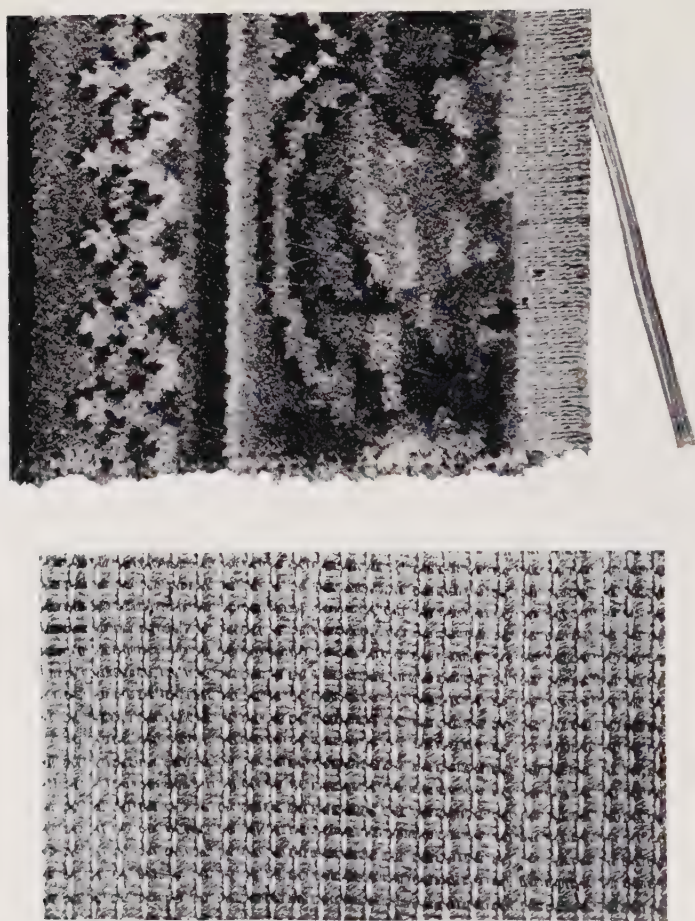


FIGURE 34

Seamless Wilton of the type shown in Figure 32, Plate II, showing front and back. The weaving diagram is shown in Figure 34, Plate II. This carpet has five frames, five colors and five shots per wire. The pile is fine worsted $\frac{3}{16}$ inch high. There are nine wires and eight double loops per inch in the pitch. Therefore, there are 144 points or tufts per square inch. The chain and the weft are made of cotton and the four stuffer threads are also made of cotton. Therefore the fabric, although very dense, is also very flexible.

Seamless Wiltons

The usual Wilton rug, except the narrowest widths, is made up of two or more strips sewn together. When wide rugs are made in one piece a different system of weaving is usually employed. The principal difference in the standard breadth looms and the seamless looms consists in using a special arrangement of wires for forming the loops.

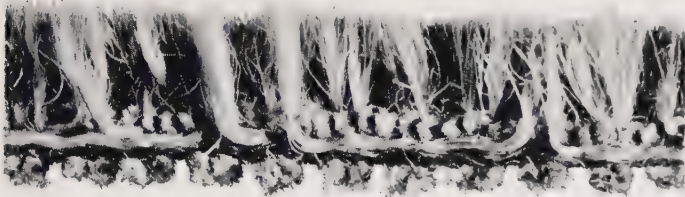


FIGURE 35

Enlarged cross-section of the seamless Wilton shown in Figure 34. This picture shows very plainly how the various colors come up at the proper point to form the pattern and are buried at other points.

In a seamless loom the wires that form the loops are arranged like the teeth of a comb along the front, and are fixed in position. The row extends clear across the loom and the wires point in the same direction as the warp. The pile threads are looped over these wires and pushed along them as shown in Figure 32, Plate II. Therefore, in a seamless Wilton the number of loops per inch can be greatly increased, as it is not dependent in any way upon the thickness of the wire, but simply

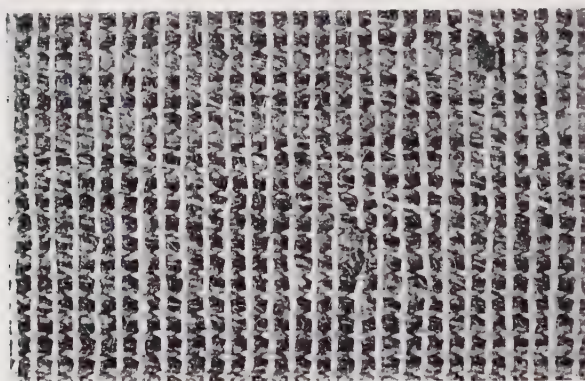


FIGURE 36

Two-shot Wilton, such as shown in Figure 30, Plate I. This particular carpet is of extremely fine quality. It has five frames, five colors, the pile is worsted 5-32nds inch high, the weft is of cotton, the two stuffers of jute and the chain of cotton. There are thirteen wires and ten pitch, making 130 points.

upon the number of loops that can be pressed side by side on the wire.

In operation, as these loops are pressed along the wire, they finally arrive at the base, which is equipped with a sharp knife-edge that cuts them open and allows them to come back into their



FIGURE 37

Enlarged cross-section of the carpet shown in Figure 36. The cut is made just in front of the chain and shows plainly the density of the pile and the weave.

natural position, which is one-quarter turn from the position they occupied on the wire. With this system of weaving it is possible to get 18 or more loops per inch, and thus make the densest possible pile. In Figure 34 is shown a seamless Wilton with eighteen wires or loops per inch of length.

Quality

The quality of a Wilton is determined in the same way as the quality of a Brussels, by the number of frames and the number of wires. The actual counting of the number of points per square inch can best be done on the back on account of the blending of the pile threads across the weave in the face.

CHAPTER VIII

TAPESTRY BRUSSELS CARPET

Tapestry carpet, sometimes known as Tapestry Brussels, is the cheapest form of looped-pile carpet made. From the weaving standpoint it is a single-frame Brussels. In other words, every bit of wool employed for pile is used for pile and not a single thread lies embedded in the body of the carpet.

This method of weaving follows as a matter of course where only one color is involved, but its use for producing carpets with patterns is made possible by printing the yarn in such a way that when it is woven into the carpet, the proper color will come at the proper point. Sometimes carpets of this type are woven in a neutral tone and the completed fabric printed with a design.

Naturally, there is no limit to the number of colors that can be used in a carpet of this kind. Ordinarily the structure of such a carpet is made up of cotton chain warp, jute stuffer or filler, worsted pile and weft of jute or linen. Figure 38, Plate II, shows diagrammatically the structure of Tapestry carpet.

The appearance of the carpet is similar to Brussels, but on account of the fact that the pile is printed it is impossible to get the sharpness and clean-cut appearance in the design that is obtained

in the Brussels and the Wilton carpets. In these carpets the outline of the various designs is hazy, but when properly worked out the haziness may be used to advantage as part of the scheme of the design.

It is interesting to note that in general the cheaper the carpet the greater the labor and care involved in preparing for the weaving process. At least it is true that Tapestry Brussels and Tapestry Velvet carpets require greater care in

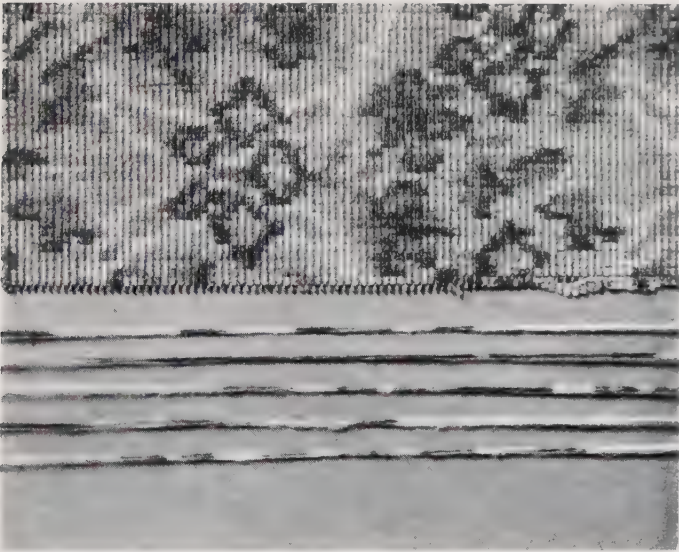


FIGURE 39

Typical Tapestry Carpet. At the bottom are shown a number of pile threads with a design printed upon them. This particular carpet has eight wires and eight pitch, giving 64 points. The pile is worsted with loops 3-32nds inch high. There are three jute stuffers, a jute weft and a cotton warp chain.

the preparation of the pile threads for weaving, than any other type of carpet. First of all the wool must be carefully selected and spun in such a way as to obtain as great a degree of uniformity as possible, because any appreciable difference in the stretching qualities of the completed threads will affect the accuracy of the design.

In making both Tapestry and Velvet carpets, long staple worsted with a very slight twist in the redoubling is used. The most interesting part of the process is the printing. The woolen threads after having been properly spun, washed and dried, are wound carefully onto large printing drums, care being taken not to strain the threads unduly in the winding, and at the same time to maintain a constant tension, or pull, on them.

Printing

In the printing process, the drum is first covered with a sheet of oil cloth over which the thread is wound in a single evenly spaced layer. The drum itself is equipped with a number of notches, each one of which represents a definite distance along the thread. Each notch is numbered so as to enable the printer to turn the drum to any desired position, using the numbers as an index. Below the drum is mounted a carrier device which permits the moving across the bottom of the drum of a pan full of printing dye, equipped with a rubber roller. The face of this roller is of

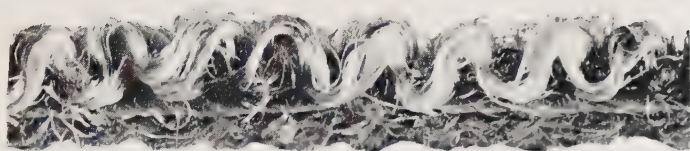


FIGURE 40

Enlarged cross-section of the carpet shown in Figure 39. The change in color of the pile is plainly evident.

such width as to print a strip, the length of which on the thread corresponds to the length represented by one notch on the drum index.

In printing the thread the printer has before him a vertical strip from the pattern. See Figure 21, Plate I. For an eight-wire carpet for example each unit or square in the pattern must correspond to $\frac{1}{8}$ inch on the face of the rug. The length of thread required to make this $\frac{1}{8}$ inch depends upon the height of the pile. If we assume that the length of thread thus required is twice the actual length on the carpet face, each unit on the face of the drum will be $\frac{2}{8}$ or $\frac{1}{4}$ inch. Therefore, each square on the pattern paper will correspond to $\frac{1}{4}$ inch on the face of the drum. In order to facilitate the actual work of printing, the strip of pattern from which the printer works is marked with numbers along the side to correspond with the numbered notches on his drum.

He begins with the lightest colors first, so that in case a mistake is made he can cover them with darker colors. Each color is mixed and placed in its own pan before the process of printing is

started. Then, beginning with the lightest color, the first pan is inserted in the carrier. The printer then reads from his design the numbers on which this color is used. Turning the drum to the corresponding notches, the pan is made to travel across the drum over and back for each position. In this way he takes one color after another until the full drum has been printed.

In removing the wet yarn from the drum, great care must be exercised not to let one color lap over the other. To prevent this, boxes filled with wet sawdust are brought to the drum and the yarn removed by partially collapsing the drum and lifting it off as a skein. It is then carefully laid on top of the sawdust and placed in a steam tight chamber where it is subjected to the action of live steam, which sets the dye and prevents it running from one part of the yarn to another.

The dye for printing purposes is mixed with a very fine grade of flour which remains in the yarn as a sticky, pasty mass. After the dye is set, this can be safely washed out and the yarn when dried will become soft and pliable.

Evidently from the time a skein of yarn is printed, its identity must be maintained. After drying, the various skeins are thrown into bins which are laid out according to a system that permits the proper grouping of the various skeins. When all the skeins of a given run have been completed, they are wound onto spools and these spools are then stored in racks which are laid out

in such a way as to indicate automatically when the number of spools required for a carpet is complete.

Setting Up

The spools are then set up in a frame which resembles the frame used on a Brussels or Wilton loom. From this frame the threads are drawn out through a reed, and a pair of rollers, and wound onto a roll called a "beam". When the threads have been stretched out in this way, they form the complete face of the rug and the pattern is developed exactly as it will appear in the rug, except that it is elongated approximately 100 per cent. In this stretching process the threads are lined up on both ends with a line that is printed on the threads for the purpose. If the pattern shows no imperfections due to the threads being in the wrong place or due to imperfect dyeing, or unequal stretch, the set-up is O. K'd and the threads wound onto the beam. This process is continued without cutting the threads until the spools are empty. In other words, a single thread will pass through a number of carpets.

These beams, with the pile threads wound upon them, are delivered to the looms, and the corresponding rugs are woven one after another until the end of the thread is reached. The weft, generally of jute, is thoroughly saturated with a special glue solution, called "sizing," and woven

wet to help hold the pile in place and to give stiffness to the carpet. The finished rugs are wound on a beam, passed through a dryer, cut up, and made ready for shipment in the same way as any other machine-made carpet.

Quality

The quality of Tapestry carpet is determined first of all by the method of printing. The process which prints the completed carpet is the cheapest and the least satisfactory, because the color does not penetrate to the bottom of the pile and therefore deteriorates as the carpet wears. Carpet printed in the piece is at a disadvantage in appearance. The loops often stick together in clots and the surface is very rough to the touch. Where the yarn is printed before weaving, better results are obtained.

The number of wires has the same meaning in Tapestry carpets as in a Brussels carpet. Frame does not enter into the determination of quality, as there is only one frame in all Tapestry carpets.

CHAPTER IX

VELVET CARPET

Tapestry Velvet, or Velvet, occupies the same position with reference to Tapestry Brussels that Velvet does to Brussels. In other words, a Velvet carpet is a Tapestry Brussels with the loops cut. The yarn is printed in exactly the same way and the weaving may be done on similar looms, although like the Wilton, Velvet is sometimes woven with more shots per wire than Tapestry. Then too, printing of Velvet is a more laborious process, because it is necessary to secure a complete penetration of the dye, so that when the loops are cut the ends will carry the full color. With uncut loops the color on the outside surface is sufficient to get the effect, although naturally if the yarn is not dyed all the way through, wear will remove the color as soon as the surface is gone.

A Velvet can be told at a glance if there are any straight lines in the border. For instance, straight lines running lengthwise of the carpet will be clean and sharp, whereas running across the carpet they will zig-zag more or less and present a hazy appearance. This characteristic is well illustrated in Figure 41.

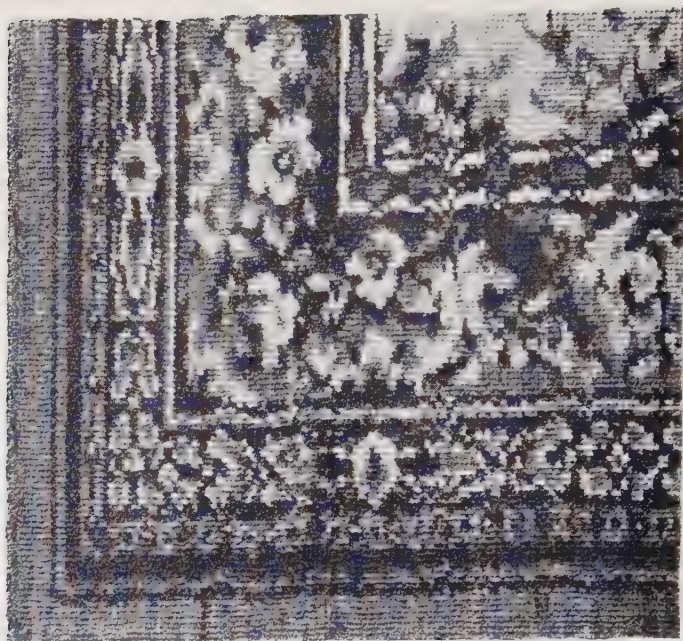


FIGURE 41

Typical Velvet Carpet. Six wires, seven pitch, making 42 points. The pile is $\frac{1}{8}$ inch high and there are three jute stuffers, two-shot jute weft, and double cotton chain. A characteristic of all Velvet carpets which have straight lines in the design is excellently demonstrated in the above illustration. It will be noted that the straight lines which coincide with the warp of the carpet are clean-cut; while those that are at right angles to the warp and in the direction of the weft are hazy and irregular. This is due to the fact that it is impossible to make the colors of the design line up perfectly in the different pile threads.

Quality

The quality of the Velvet carpet in addition to the materials and the number of points per square inch is also determined by the method of weaving.

Figures 42 to 45, Plate II, show four different

methods of weaving the Velvet carpet. The one in Figure 42, Plate II, contains two shots of weft to every wire. It is not to be recommended on account of the fact that each loop of pile is bound at only one point. The one in Figure 43, Plate II, is something of an improvement over the first one in that the chain is pulled down tighter around the weft than in the first system. In this structure we have three shots of weft per wire. This structure also gives a stronger foundation for the carpet, on account of the extra weft threads on the bottom. Figure 44, Plate II, shows another arrangement of three shots of weft per wire in which each loop is bound at two points. This method gives a much better grip on the pile loops and holds them more firmly in place. Figure 45, Plate II, in which there are shown four shots of weft per wire is best, because it gives a stiffer bottom and at the same time holds the pile loops at two points for each loop.

The best quality Velvet is woven with nine wires. However, most Velvet is seven and eight wires and even goes as low as six wires.

Under Tapestry Brussels it is mentioned that carpets of this type are sometimes woven in neutral tones, and the design printed on the surface of the completed fabric. The bottom of each loop is white; whereas the top surface is colored. The Velvets printed in this way are even less satisfactory than Tapestries, because the tendency to clot is greater.

AXMINSTER

Axminster, sometimes called Moquette, is closely related to the Oriental, because it permits the use of an unlimited number of colors in the design and is woven according to a system that closely approximates the Oriental system. Machine-made Axminster carpet was developed in the United States. It involves the use of very highly organized machines which do the work of human fingers, by looping each individual tuft of wool into the body of the fabric.

There are two distinct types of Axminster carpet, namely: the narrow width which is sewn together to make rugs and carpets, and the seamless which is woven full width. The narrow width goods is by far the most common.

The usual method of weaving the narrow goods is to employ a loom equipped with a series of spools on which the woolen yarn for the pile has been wound. The length of the spools equals the width of the carpet, and from each spool is taken in proper order the necessary wool for one row of pile.

These spools are prepared by setting up bobbins in a frame similar to that used in a Brussels or Wilton loom. The girls who wind these spools are given a horizontal strip from the pattern (see

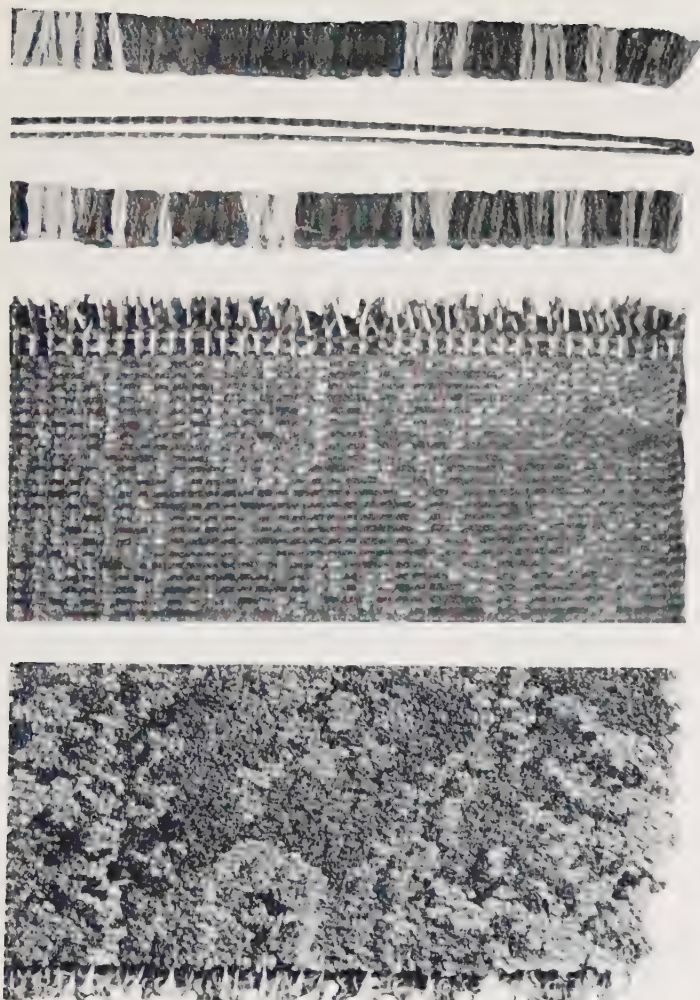


FIGURE 48

Imperial Axminster of very fine quality. The pile is fine worsted $\frac{3}{8}$ inch high with ten beat-up and seven pitch, making 70 points. Three double shots of jute weft, double cotton chain and one cotton filler are used. As may be seen from the illustration the design shows plainly on the back, see Figure 46, Plate II.

Figure 21, Plate I), for each spool, and they set up the pattern by drawing woolen threads from the frame and setting them in the order indicated by the pattern. Each spool represents one pick or row of tufts in the design. Therefore, it is only practicable to make this type of carpet in quantity, because there is not more than a couple of inches of yarn used from each spool for each repeat of the pattern. In practice it is usual to use not less than 500 repeats from every design.

Weaving

After a spool has been wound, the ends of the yarn are cut straight and inserted in small metal tubes, which act as guides. All this is preliminary to the weaving. The spools arranged in proper order to bring out the design are then mounted in an endless chain which carries them to the loom. The chain stops during the operation of looping the pile into the fabric, and then moves up the distance of one spool after the operation is complete.

The body of the carpet is woven in the usual way. The warp is made of linen or cotton threads, while the weft is usually of sized jute. The pile is usually woolen yarn.

The unique part of this process is the method employed to insert the pile. The spool with its tube attachment is brought down to the fabric into which it is to be inserted. Out of each tube there

extends an end of woolen yarn presenting the appearance of a carefully trimmed fringe. These ends are laid across a weft thread, the tubes passing through the fabric and between the warp threads, then the weft is carried across by means of a needle from one side and looped about a binding thread, which is manipulated by a small shuttle on the opposite side. It then returns to its original position and the tubes draw the wool up



FIGURE 49

Back of ordinary Axminster of the type shown in Figure 47, Plate II. The weft threads run vertically in this illustration and show plainly that the stiffness is across the carpet. The warp threads which bind the weft threads together run horizontally in the illustration and are of cotton; while the weft threads are of jute. Therefore, the carpet is very flexible in the direction of the warp and very stiff in the direction of the weft.

around the weft, after which the needle goes across and back again completing the fastening of the tufts.

It will be noted that the method by which the weft is handled in this type of loom is exactly similar to the process of sewing with a sewing

machine. Instead of the usual weaving shuttle, we have a needle and along one side we have a small shuttle which reciprocates and performs the same function as the shuttle in a sewing machine.

There are several methods of weaving Axminster rugs and carpets, the best known is the spool Axminster (above described) originally called Moquette. A good example of high-grade Axminster is shown in Figure 48. A cheaper grade is shown in Figure 49. It will be noted that the weft

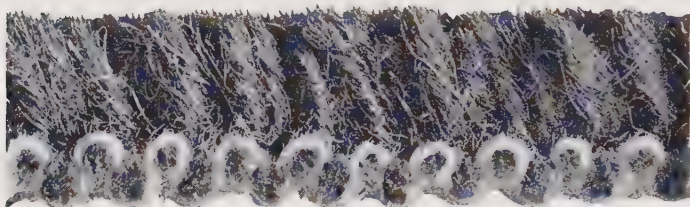


FIGURE 50

Enlarged cross-section of an Axminster carpet of the type shown in Figure 47, Plate II, and in Figure 49. The single chain shows very plainly.

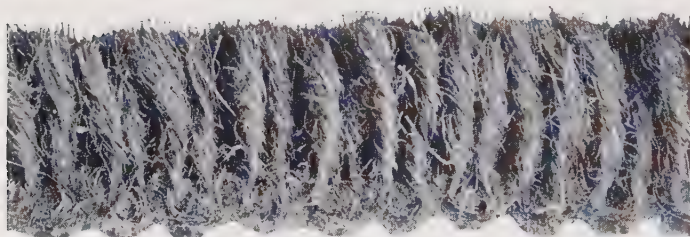


FIGURE 51

Enlarged cross-section of the same Axminster as shown in Figure 49, with the chain removed and the weft threads clipped back. Sharp twist of the woolen pile is plainly evident.

threads are of larger size and differently arranged than in the higher grade piece, and that the rows of tufts are farther apart. In other words, the body of the fabric is less firm and there is a smaller quantity of wool employed.

Seamless Axminster

The seamless Axminster may be woven by the same method as above described, although it is also produced in a special loom, which combines some of the characteristics of a Wilton or Brussels loom and the regular Axminster loom. The colors are arranged in frames exactly as is done with the Brussels, and the end of each worsted or woolen thread is held in a clamp. A Jacquard mechanism is used to raise any desired group of colors to a certain line or level in the machine, where a corresponding set of mechanical fingers grasps the ends of the threads and draws them out a fixed distance, at which juncture they are cut off with a sharp knife. These fingers, each grasping a tuft of wool, descend into the fabric and hold the ends of the tuft until they have been woven in by the weft passing through the loop and on both sides of it.

A typical weave of this type is the Karavan rug, a cross-section of which is shown in Figure 53. It would take an expert to be able to tell that this rug is not hand-made, as the pattern comes through perfectly on the back and the tufts are

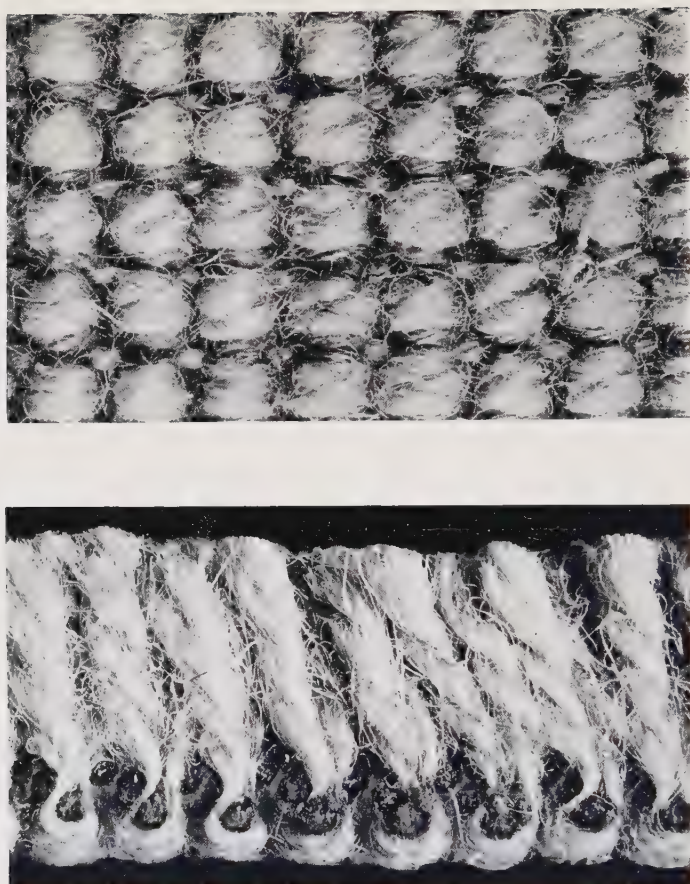


FIGURE 53

Enlarged back view and cross-section of Karavan Seamless Axminster. This picture shows the remarkable resemblance of the weave to an Oriental or hand tufted carpet. This particular carpet is made with woolen pile $\frac{3}{8}$ inch high, three double shots of jute weft, two cotton warp chains and one cotton stuffer. The beat-up is eight and the pitch seven, giving 56 points. The weave is illustrated in Figure 52, Plate II.

looped in such a way as to resemble very closely a hand-tied knot. (See Figure 52, Plate II.)

Quality

The quality of Axminster like all other machine-made carpets depends largely upon the amount of wool used in proportion to the other materials. It is an economical type of carpet because all the wool used appears in the face of the carpet, and wherever a pattern is made in large quantities the cost of manufacture is very reasonable. Therefore, the usual Axminster is a reasonably inexpensive carpet. Like all other carpets of the tufted variety, its quality may be judged with fair accuracy by the number of tufts per square inch and the length of the tufts.

The rows are easily counted from the back of the carpet, but the tufts in a row are best counted by opening the carpet from the front and inserting a piece of cardboard 1 inch long as shown in Figure 78.

Best quality Axminsters have from 63 to 77 tufts per square inch. The fineness of the surface depends upon the quality of wool used. Cheap Axminsters are made of woolen yarn manufactured from noils, or combings, of wool. The best quality Axminsters are made of high-grade long staple woolen and worsted yarns.

A typical characteristic of Axminster rugs results from the use of jute in the weft which makes

the carpet very stiff crossways and very flexible lengthways. Therefore, Axminster should always be rolled and never folded. Best grade Axminsters use linen chain warp instead of cotton.

CHAPTER XI

CHENILLE

Chenille, sometimes called "Chenille Axminster," is woven according to a system quite different from all others. It is a two-stage process.

The first stage of the process consists in weaving a cloth known as Chenille. In this process the shuttles carry the wool and only one color is woven at a time. Therefore, any number of colors may be used. The warp is spaced in groups at intervals which determine the length of the pile in the finished carpet. In weaving, this warp is laced in such a way that it is held together in a bunch, and a pull produced from one side which tends to curve in straight rows as shown in Figure 54, Plate III. The pattern is developed by weaving the colors in proper sequence in the Chenille cloth, a sample of which is shown in Figure 55.

Weaving Cloth

The weaver of the cloth is provided with a horizontal strip from the pattern paper (see Figure 21, Plate I), on which is indicated the color of thread for each shot of weft. She has at hand shuttles with as many different colors of yarn as will be required, so that she can throw in the proper color for each shot as indicated by her pattern paper.

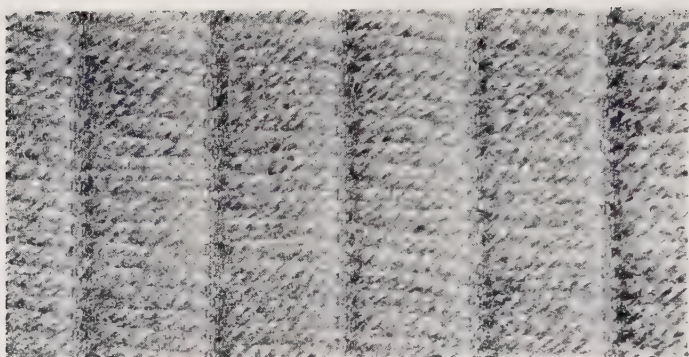


FIGURE 55

Section of Chenille cloth from the front. Each length of cloth corresponds to a strip of Chenille fur which is used for pile, there being as many strips of the same pattern per length of cloth as there are groups of warp threads. The color for each individual tuft in the pile is determined by the color of the weft thread in the Chenille cloth. The weaver has at her side shuttle bobbins of as many different colors as are required in the pattern, which she inserts at the proper point as indicated by a horizontal strip cut from the paper as shown on Plate I, Figure 21.



FIGURE 56

Enlarged front view of the warp threads from the Chenille cloth shown in Figure 55.

The cloth is next inserted into a machine where it is cut into strips mid-way between the rows of warp. As it comes from the cutters it is subjected to steam and then it passes into deep grooves of

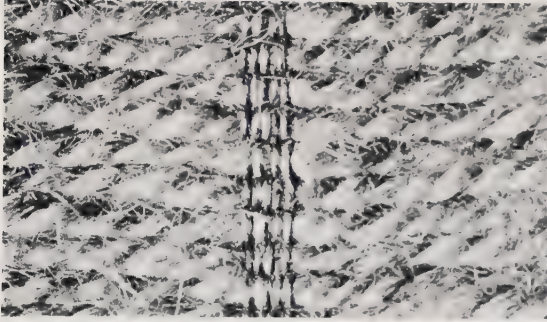


FIGURE 57

Enlarged rear view of the warp threads from the Chenille cloth shown in Figure 55

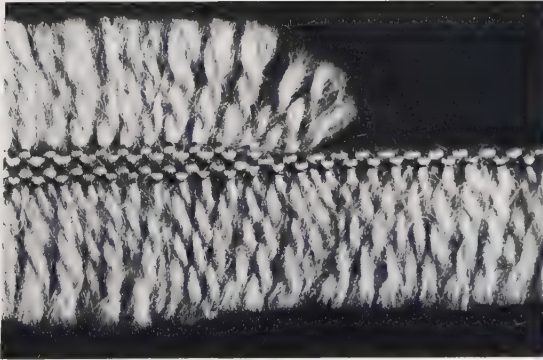


FIGURE 58

Enlarged view of the Chenille cloth after it is cut into strips. At the left it is shown as it comes from the cutters, and at the right as it is folded and pressed in the iron grooves.

a heated iron roll, which fold it tightly together, the heat sets it and it remains as shown in Figure 58. These strips are called "fur" and are now ready for use in the carpet weaving machines.

Figure 54, Plate III, shows the various stages in the process of making the fur. The cloth is woven as shown in A, it is then cut into strips as in B, and folded as in C.

Weaving Chenille Carpet

The carpet itself is made up of a fabric or back composed mostly of yarn made from cattle hair. There is one type of Chenille made with a linen or cotton back as shown in Figure 66. Upon the backing the Chenille fur is laced by means of linen or cotton warp threads. The process of inserting fur is practically a hand operation. The fur is drawn through the shed by mechanical means, but it must be positioned by the weavers so as to develop the pattern. Once in position it is combed up and beaten home by a hand-tool that is similar to the comb used by the Oriental weavers. The weaving process then continues forming up the back and lacing down the strip of fur, after which another strip of fur is inserted and so on.

On account of the fact that the face of the carpet is determined by the weaver laying a strip of fur in any desired position, it is possible to weave Chenille carpets in very great widths. In fact, the standard widths run up to 30 feet and

more. Another advantage is the ability to weave irregular shapes, such as oval, L-shaped or of the exact shape to correspond to any given room. When making odd-shaped pieces the body of the carpet is woven rectangular, but the Chenille is laid on to correspond with the pattern. Afterwards the body is cut to conform to the face of the rug and bound under, so that it will not unravel.

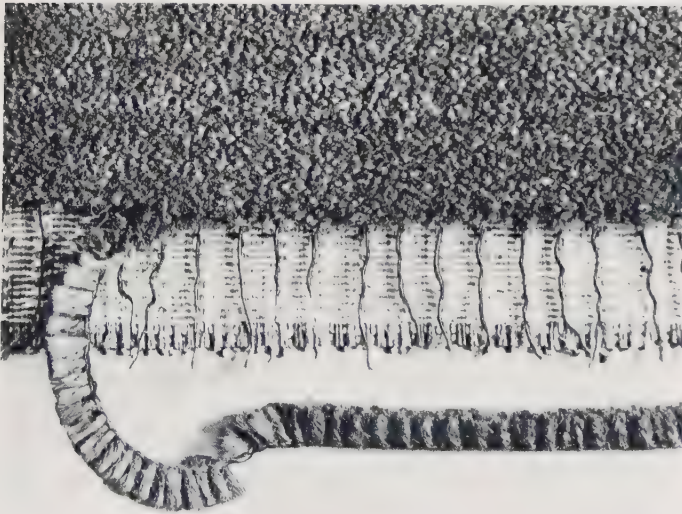


FIGURE 59

Woolen Chenille Rug with flexible cotton backing. The illustration shows plainly how the Chenille fur is attached to the backing to make the pile. The catcher threads may be seen hanging down below the edge of the pile. The weave of this particular carpet is shown in the diagram in Figure 68, Plate III. The beat-up is eleven and the pitch eleven, making the density 121 points. The cotton backing is rather unusual, giving very thin and flexible body to which the pile is attached. The weave of the backing is shown in Figure 66. The pile itself is $\frac{1}{4}$ inch high.

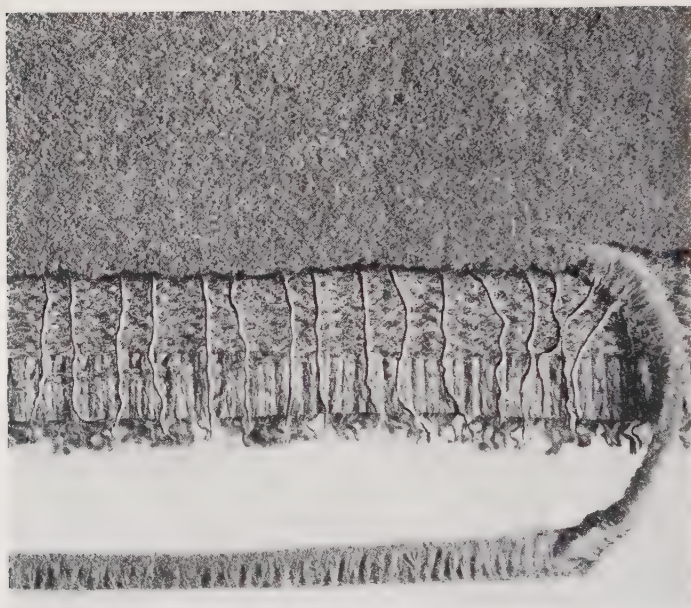


FIGURE 60

Chenille Rug made with worsted pile and heavy wool back. The wool back is in reality made of cow hair yarn. The reproduction is to the same scale as the one shown in Figure 59. Therefore, it affords an excellent comparison between the surface finishes of a wool pile and a worsted pile. The weave of this particular rug is shown diagrammatically in Figure 69, Plate III, and the back is shown in Figure 64. The pile is $\frac{1}{4}$ inch high, the beat-up is ten and the pitch 21, making the density 210 points.

Smyrna Rugs

A type of Chenille rug which is woven with a pile on both surfaces is known by the trade-name of Smyrna. In making this rug, the Chenille is cut into strips but *not folded* up, so that when it is woven as weft the loose ends project in both

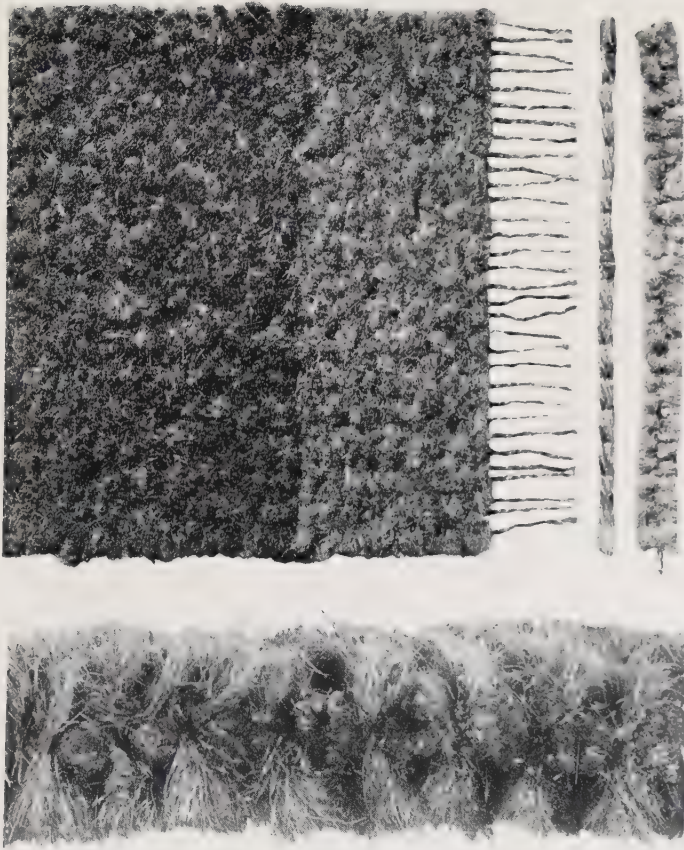


FIGURE 62

Sample of Smyrna rug showing surface, cross-section through the weft and one of the strips of Chenille fur which are woven in as weft. The weaving diagram is shown in Figure 61, Plate III. The pile measuring from the middle is $\frac{3}{8}$ inch high, the thickness of the rug being $\frac{3}{8}$ of an inch. The beat-up is six and the pitch is seven giving 42 points.



FIGURE 63

Very fine Chenille rug. This rug is made with fine worsted pile $\frac{3}{8}$ inch high. The pitch is 24 and the beat-up eleven, giving 264 points per square inch. The backing is so thin and flexible that the design is plainly visible from the back. Examining the rug from the top, even an expert would have difficulty in distinguishing it from an Oriental, both on account of its density and its beautiful coloring.

directions. A filler is inserted by alternating the pile weft with jute or other suitable filling material. An example of this type of rug is shown in Figure 62 and in Figure 61, Plate III.

Quality

The quality of Chenille carpet like most others depends largely upon the amount of wool used. As far as price goes, it also depends upon the character of the pattern. On account of the fact that all the wool is on the face of the carpet and none in the body, Chenille makes more efficient use of the wool in the face than any other type of carpet. In fact, this characteristic is at once a disadvantage and an advantage. The disadvantage is that the pile is simply caught to the body of the carpet at a comparatively small number of points. For this reason it is important in choosing a carpet of this kind to inquire whether these threads are linen or cotton. Naturally, linen is very much better for the purpose.

It is also well to examine the carpet as shown in Figure 81 to determine how frequently it is caught to the back, because once these threads break trouble is sure to follow.

Chenille pile is made with both worsted and woolen yarn, depending upon the quality and length of the pile. Figure 60 shows a Chenille with worsted pile, while Figure 59 shows one with woolen pile. The difference is easily discernible

from the face of the carpet by the size of the tufts, the wool being much coarser and rougher than the worsted.

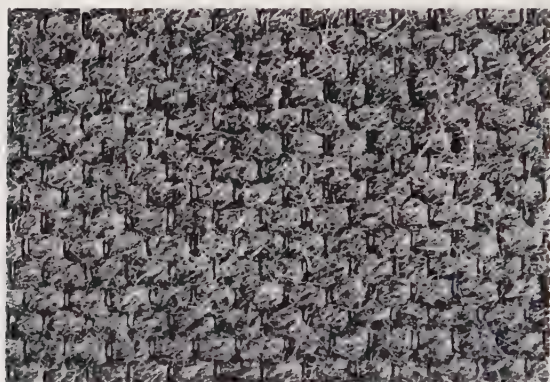


FIGURE 64

Typical heavy black Chenille.



FIGURE 65

A heavy black Chenille of slightly different weave than that shown in Figure 64.

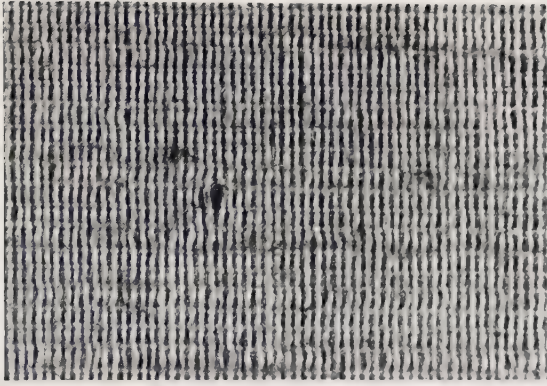


FIGURE 66

Cotton back Chenille. A front view of this carpet is shown in Figure 59.

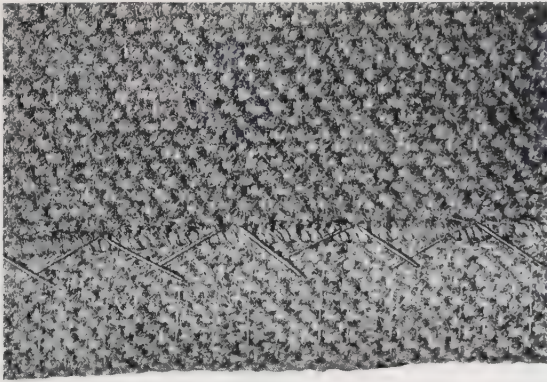


FIGURE 67

Method of binding Chenille rugs. The back is turned over and hemmed as here shown.

Most Chenilles are made in solid colors, although it is possible to use an unlimited number of colors, and thus imitate almost perfectly

genuine hand-made Oriental rugs. Figure 63 shows an excellent Chenille rug of this type. Without looking at the back of the rug it would be dif-

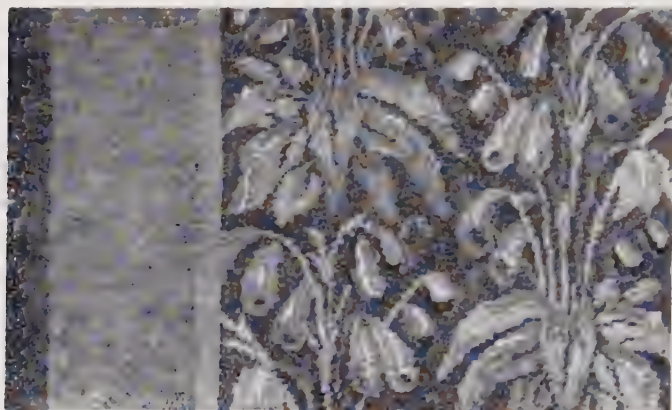


FIGURE 70

An example of Chenille carpet of large figured design.

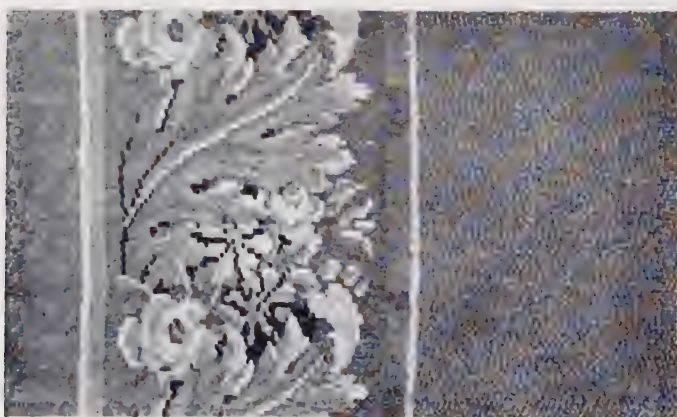


FIGURE 71

An example of Chenille carpet with mottled center and figured border.

difficult for even an expert to tell it from a fine Oriental.

On account of the way it is woven, it is very difficult to count the number of tufts in a Chenille rug. The rows are easily counted but the number of tufts in a row is almost impossible to count. Figure 78 shows the method of counting the number of tufts in a row. The piece of pasteboard here shown is 1 inch wide and when the carpet is opened up in this manner, it is possible to count the number of threads along the edge of the pasteboard. In the finest Chenilles there are as many as 144 tufts per sq. in., and by using double threads the number of loops is actually 288, which is equal in density to the finest Oriental carpets.

CHAPTER XII

HOW TO SELECT A RUG

A person about to purchase a rug usually starts with a definite price limit in mind. Therefore, in discussing the qualities of various rugs, it is perhaps best to divide the subject into three groups, namely: low, medium and high.

The selection of color and pattern is a matter of personal taste and depends entirely upon the

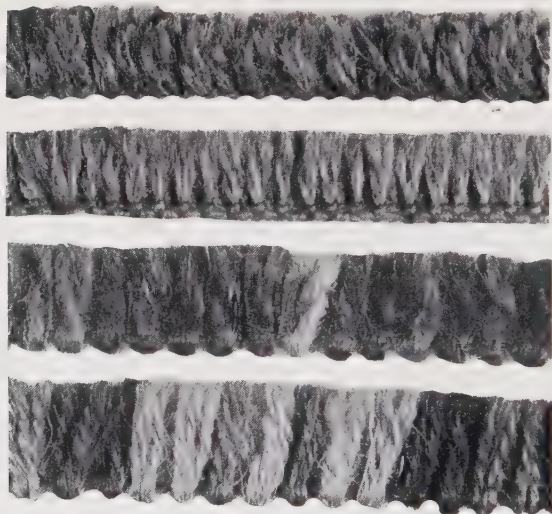


FIGURE 72

The difference between worsted and woolen pile is shown in the above cross-sections. The top shows woolen pile taken from a Chenille rug, the second shows worsted pile taken from a Chenille rug. The third shows woolen pile from an Axminster, and the bottom, worsted pile from an Axminster.

education and natural talents of the purchaser. The question of durability is not always determined by the quality as represented by price, because durability in the true sense of the word involves the length of time during which the beauty and original appearance of a carpet or rug are retained. Sometimes a floor covering loses entirely its original beauty and appearance long before it is worn out as a fabric.

Ordinarily rugs and carpets are purchased with the idea that they will last a number of years—usually they wear out sooner than the purchaser expects. Therefore, any information that will assist the purchaser to select a durable rug should be of interest and value.

Low-Priced Rugs

The price of a rug is determined by the quality and quantity of material employed, and by the time and labor of manufacture. The Tapestry is the cheapest carpet. It requires the smallest amount of material and is woven at the highest speed. The material used in the face to form the loops is usually of good quality, because it has to be in order to save time in weaving.

The Velvet comes next to the Tapestry in cheapness. The extra cost is due to the fact that it must be woven more slowly and dyed more thoroughly. Its wearing qualities are no better than the Tapestry when made of equal materials.



FIGURE 73

Method of examining the weft threads on the top surface of a carpet.

The spool Axminster made with woolen yarn comes third. Price depends upon the quantity of wool employed. The cheapest grades scarcely cover the surface. In such cases one can plainly see the jute backing between the rows of tufts. This type of carpet is practically the same in durability as the Velvet. The cheap Axminster can be told at once by looking at the back, as the back presents a distinctly ribbed appearance, the ribs extending crosswise as shown in Figure 49.

Many Tapestry, Velvet and Axminster rugs are woven in one piece without seams.

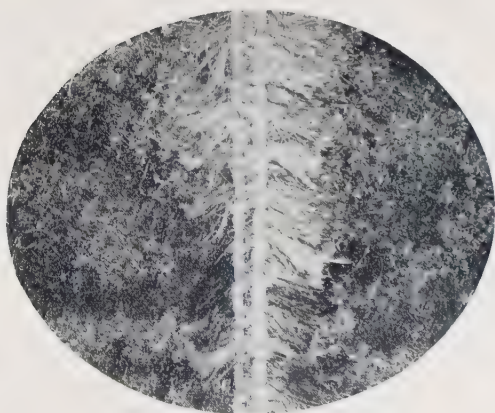
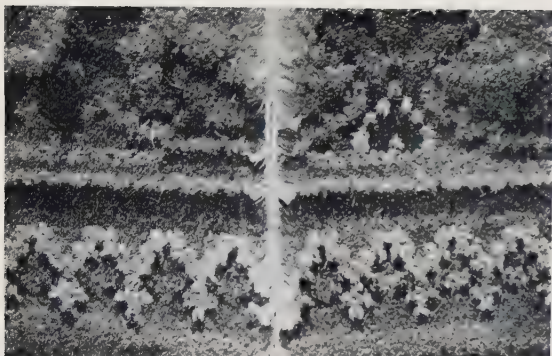


FIGURE 74

Three-shot Wilton with two shots on the top. The pile has been parted along one of the weft shots, showing plainly two of the weft threads along each row of tufts. The chain may be seen in the enlarged portion where it passes over the weft threads. In each case it will be noted that the chain passes over one and under the other. In a three-shot Velvet the chain passes directly across the two threads.

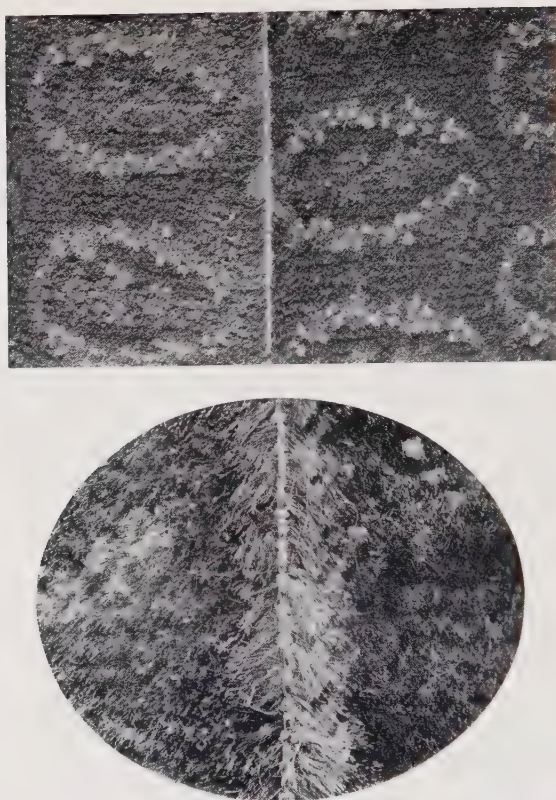


FIGURE 75

Two-shot Wilton. The pile has been parted along one of the weft shots, showing plainly in the enlarged portion that there is only one shot between each row of tufts.

Medium-Priced Rugs

The medium-priced rug is more difficult to classify because it involves the distinction of grades of a given type. Brussels is the only type that

can be definitely fixed as a medium-priced floor covering. Brussels being made of high-grade materials and at the present time not particularly popular, the price on the basis of quality and durability is extremely reasonable.

The Imperial Axminster perhaps comes next in quality. In materials it is not quite as good as the Brussels, but being a cut-pile carpet and much in vogue it ranks considerably higher in demand than



FIGURE 76

Tweezers will be found of great usefulness in connection with the study of floor coverings. They serve to part the pile so as to examine the weave from the top surface. With them one can pull out tufts and dissect a carpet with the greatest delicacy.

the Brussels. The exact quality depends upon the amount and the quality of wool employed. Some Imperial Axminsters are made with fine worsted, in which case with proper pattern the result is as beautiful as an Oriental. These Axminsters are usually woven in carpet widths and sewed together.

The Imperial Axminster is woven as shown in Figure 48 which gives a very much less ribbed



FIGURE 77

In counting the number of tufts or squares per inch, it is convenient to have a piece of pasteboard, the end of which is exactly 1 inch wide, which can be placed against the carpet surface as here shown. Then it is simply a matter of counting the number of squares within the length of the measuring unit. Orientals, Brussels, Wiltons, Tapestries, Velvets and Axminsters permit the counting of the beat-up and the pitch from the back as here shown.

appearance than the cheap Axminster, and the pattern shows through the back.

The ordinary grade of Chenille is a medium-priced carpet. It has come into considerable vogue due to the great variety of wide widths in which it can be obtained, and also due to the fact that single-tone carpets are in great demand. Single-tone Chenilles made with woolen pile are usually provided with a heavy back. The lower priced Chenilles are practically always single or double-tone rugs without pattern. Sometimes they are provided with a plain border. The quality depends upon the amount of wool used. In buying a Chenille rug it is well to examine the catcher thread as shown in Figure 81 and inquire as to whether it is cotton or linen. Linen is preferred although not always obtainable.

Wilton is distinctly the best buy in the medium price group. The process of manufacture is such that a certain grade of quality is essential. For instance, worsted yarn is practically always used for the pile. Then too, where there is a pattern with a number of colors, a considerable quantity of worsted must also be included in the body of the carpet. The better grade Wiltons usually contain five or six colors; that is, five or six frames. Therefore, in a six-frame Wilton for instance, there is five times as much wool in the body of the carpet as in the pile itself. This produces an extremely flexible light-weight and yet dust-tight fabric. From the manufacturer's standpoint Wil-



FIGURE 78

Some Axminsters are so constructed that it is easier to count the pitch from the front than it is from the back. The above illustration shows how the pitch can be counted from the front. The beat-up or number of rows is more easily counted from the back.

ton is uneconomical and probably will gradually be displaced by carpets of the Axminster and Chenille types.

High-Priced Rugs

It is possible to weave Axminsters when light-weight weft threads are used in such a way that they closely resemble Oriental rugs. Axminster

weaving is a pure machine process but setting up the pattern and preparing the wool for the weaving with the various colors in their proper places



FIGURE 79

In Chenille Carpets there is no relation between the squares in the face and the back; that is, the number of rows of pile and the number of tufts in a row are in no way related to the weaving in the back. Therefore, all pile counts must be made from the front. To count the beat-up or the number of rows of pile, an easy way is to open the pile at one point and insert a small piece of paper, lay the measuring device against this piece of paper and insert the tweezers into the pile at the other end. Then open the pile at the nearest row and insert a piece of paper, checking up the distance between the two pieces of paper as shown in the illustration at the right. After the two pieces of paper have been inserted and checked up, roll the carpet as shown above so that the rows are opened up plainly. It is then a simple matter to count the number of rows between the two pieces of paper—this will give the beat-up.



In counting the pitch or number of tufts per inch width in the Chenille, the measuring piece is inserted between the rows as shown in Figure 78, and the number of weft threads in the Chenille counted. This is a difficult operation and should be repeated a couple of times in order to make sure the count is correct. In making the count, the pasteboard should be inserted at the very bottom of the row and the row of pile pulled over until the warp threads which bind the wool together are plainly visible. These warp threads will enable the observer to separate the weft shots in the Chenille and thus count the pitch.

is a slow job that must be done by hand. Therefore, when exclusive patterns are employed and only a small number of rugs woven in each pattern, the Axminster becomes an expensive fabric. Some of the foreign-made Axminsters are produced in small quantity groups and utilize the finest materials. Such rugs when made of suitable pattern compare favorably with Oriental weaves as to durability and appearance. Indeed, many of them cannot be told from Orientals except by experienced persons. Unfortunately, such weaves are seldom produced except in narrow widths. Therefore, they must be sewed together to form a rug of any considerable dimensions.

Chenilles enter the high price class when the patterns are exclusive, because like the Axminster the setting up of the pile for a given pattern is a fairly expensive operation. However, it is not as expensive as in the Axminster, and therefore it is not unusual to purchase Chenille rugs in which each rug is woven to an individual pattern. In fact, there are manufacturers who will take orders for individual Chenille rugs of any shape or pattern. The cost is determined largely by the size of the pattern. Small patterns repeat more frequently and therefore cost less to set up; while large patterns are correspondingly more expensive.

Some Chenille rugs, for instance, such as the one shown in Figure 63 employ a backing so thin that the complete pattern shows through. Rugs



FIGURE 80

This illustration simply shows how the pile of an Axminster can be separated so as to examine the weft shot between the rows on the front surface.

of this kind are woven with most intricate patterns with pile of extremely high density, and therefore can be made to resemble fine Oriental rugs so closely that no one but an expert might tell the difference.

Oriental rugs are produced in a great variety of qualities and prices, but in general they all come in the high-price group. The price of an Oriental is not entirely based on its cost. The pattern is an important factor, and in many cases the price is a result of bargaining, especially where small dealers are concerned.

Before buying an Oriental rug it would be well to consult someone who is informed on the sub-

ject, and when such a person is not available the next best thing is to purchase from an absolutely reliable dealer.

In manufactured rugs the quality is fairly easy to recognize and competition is so clean cut that there is less tendency for the dealer to deceive the purchaser. With Oriental rugs the variety of design is so great, that the dealer may easily place a different price on every pattern with no variation in quality.

Roughly, the quality of an Oriental rug from the standpoint of durability can be determined by



FIGURE 81

In this illustration a Chenille is being examined, with the idea of inspecting the catcher threads.

feeling the texture of the wool, the flexibility of the weave, counting the knots per sq. in., examining the pile to see whether it has been washed and repainted—in fact, doing many of the things that are outlined in the chapter on Oriental rugs, page 20.

European hand-tufted rugs as a class are more expensive than Oriental rugs, because Oriental labor is cheaper. In fact, it is sometimes possible to turn out hand-tufted rugs in the Orient at prices which compare with machine-made fabrics. The European hand-tufted rugs are usually woven to order, the price being determined by the type of weave and the pattern. It is based on the number of square yards in the rug.

Durability

The durability of a rug is determined by the quality of the material and the type of weaving employed. In general, durability is a function of price, the low-priced rugs being the least durable.

Rugs wear out from three principal causes.

1. Abrasion due to rubbing the surface either in process of cleaning, scuffing the feet or dragging objects over its surface.
2. Bending the pile first in one direction, then in another which causes the fibers to break and become loose.
3. Cutting at the base due to the presence of sharp cutty imbedded grit over which the pile is bent.

The resistance to abrasion is a function of the wool itself. Long staple worsted has by far the greatest resistance to abrasion. Any carpet can be tested for its sensitiveness to abrasion by rubbing it briskly with the palm of the hand and noting the amount of fluff which is produced. The

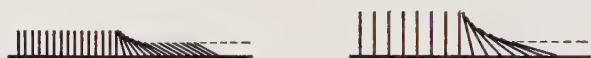


FIGURE 82

Diagram showing the relation between density and height of pile. The diagram at the left shows a pile of certain height and density; while the one at the right has twice the height and half of the density. Therefore, there is the same amount of wool above the body in both arrangements, and when walked upon the pile will be compressed to a height corresponding to the amount of wool above the body, irrespective of the height of pile or its density. In other words, the effective thickness of the pile of a carpet depends upon the pounds of wool in the pile.

salesman will always explain that this fluff is merely dead nap produced in the process of weaving, and that once it is removed it will cease to appear. However, by continuing the rubbing process it will be found that all the pile can be removed from the carpet in the space of an hour or less.

The resistance which a carpet offers to wear by bending is a function of its flexibility. When a carpet is stepped on, or a piece of furniture, or a load of any kind is placed upon it, the fibers are crushed down and must bend. The angle through which they bend is determined by the density of the pile and its length. Long pile will bend more than short pile. This is illustrated in Figures 82 to 86. The diagrams shown in Figure 82 indicate



FIGURE 83

Walking upon a Wilton which has a short and extremely dense worsted pile. It will be noted that, though a weight of 200 pounds is carried by this foot, there is scarcely any compression of the pile.



FIGURE 84

The same test as shown in Fig. 83 is here applied to a Chenille carpet having a long wool pile. It will be noted that the pile is compressed to practically the same effective height as the short and denser Wilton in Figure 83.

two carpets, each one of which has the same amount of wool in the pile. One of them has twice as many tufts of a given height; while the other has half as many tufts of twice the height. In walking on these rugs they will both crush down to the same thickness which is determined by the amount of wool, entirely independently of the height of the pile or the number of knots. However, it will be noted that the angle through which the wool is bent is very much greater with the long pile than with the short pile.

In general, the short-pile carpet is more durable than the long pile, although this cannot be taken as a definite rule because the quality of material and the flexibility of the structure enter in the durability.

If a thread of wool, such as is employed in a tuft, is held firmly at one point and bent over as shown in Figure 85, the individual fibers must



FIGURE 85

When pile is walked upon it must bend one way or another, and the angle through which it bends is determined by the density of the pile and by nothing else. When pile bends, the various wool fibers are forced to slide one against the other. The diagram at the right demonstrates the sliding action which must take place when a tuft of pile is bent. In this case the maximum sliding is represented by the displacement of the fibers farthest from each other, and is denoted as, a . Evidently the density of the pile is a factor in the durability of a carpet; everything else being equal the carpet with the densest pile should wear longest.

slide on one another. Wool fibers are covered with tiny scales; therefore, they offer great resistance to sliding. Consequently, when a thread is bent as here shown the sliding of one fiber on another is opposed with great resistance and the weaker fibers are sure to be pulled apart, after which it is only a matter of time before they become detached from the rug.

Consider again Figure 85 and assume the tuft of wool fibers is to be bent from one side to the other, as is the case when a carpet sweeper is run over a carpet. This again produces a considerable amount of friction as all the fibers are forced to slide back and forth over each other. Anyone can demonstrate this action for himself, by placing his two hands together and bending the two first in one direction and then in the other. He will find that they slide over one another in exactly the same way as the fibers in a tuft of wool that is being bent first in one direction and then in another.

It is immediately apparent that flexibility of support will go a long way toward eliminating the bending and consequent sliding upon one another of the tufts, because when flexibly supported the whole tuft is permitted to roll. In Figure 86 several of the best known carpet types are considered in the order of their flexibility. The cheap Axminster is the worst, and the Chenille the best from the standpoint of flexibility of the connection between the main structure of the carpet and

the pile. Therefore, other things being equal, there will be less wear due to bending in a Chenille rug than in others.

Sharp cutty imbedded grit is equally offensive in all carpets. However, the amount of visible wear produced is largely a matter of the softness of the structure. A hard structure, such as jute when covered with sand or other grit, is unyielding so that the wool when crushed over it gets the full cutting value of the grit. Cheap loosely woven fabrics sometimes suffer less from imbedded grit than more expensive ones, because

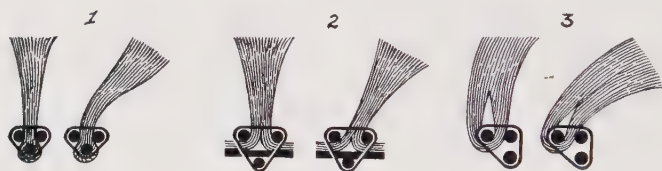
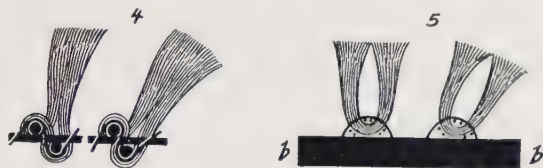


FIGURE 86

When a carpet is walked upon the pile must bend, and the resistance which is offered to bending has an important effect upon the durability of the pile. Examining some of the fundamental types of carpets with this point in mind, an idea of their relative durability when judged from the standpoint of flexibility can be obtained. The above sketches show a number of typical weaves. (1) Is an Axminster weave employed mostly in cheap grades. Heavy jute is used for weft and the loops are made around the jute weft and bound tightly between two other shots as shown. The pile stands perfectly upright in its normal position, and when it bends it is subjected to a sharp bending action at the point where it emerges from the body of the carpet, and repeated bending will break the pile at this point. (2) Shows a Wilton weave. This attachment is somewhat more flexible than the one shown in 1, and the more frames that are used the more flexible is the joint. However, the principal advantage of this weave is the density, shortness, and quality of pile. While wool is usually used in 1, worsted is almost always used in 2. 2 will stand almost straight up under a considerable load; while 1 will bend through a considerable angle. Then, too, the weft threads in 2 are made of linen or cotton, which is much more flexible than jute. On the other hand, 1 may be so woven that the entire unit weft threads, pile and all, will roll over to a certain extent under a load. (3) Shows an Imperial Axminster. This is a very flexible means of attachment. It also has the characteristic of extreme flexibility in the direction of the warp, and extreme stiffness in the direction of the weft, because the weft threads are usually

their structure is so open that a great deal of the grit sifts through to the floor underneath.

There is no excuse for allowing grit and sand to accumulate at the base of the pile when proper cleaning is all that is required to remove it. Therefore, there is no need to give consideration to this factor in the purchase of a rug.



jute, while the warp chain is cotton. The result is that the complete unit, weft threads, pile and all can roll to a certain extent. However, considerable bending of the pile must take place before enough force can be applied to roll the weft. Therefore, it cannot be given much credit compared to the flexibility of the attachment between the pile and the body of the carpet. In this case the pile has a natural lay to one side as shown in Figure 92, which makes the amount of bending under load much less than would occur if the pile stood perfectly upright. (4) Shows an Oriental weave with a Senna knot. In some respects the characteristics of this weave are similar to the Imperial Axminster in 3. This knot has a lay as shown in the sketch at the right. Opening as it does toward the direction of the lay, it can be compressed considerably without any appreciable amount of bending at the point of support. The warp, weft and chain in this weave are usually made of cotton or some equally flexible thread, so that the construction is extremely flexible. The flexibility resulting from the particular construction employed in most hand-tufted rugs is probably responsible, more than any other one thing, for their good wearing qualities. (5) Chenille rugs are in a class by themselves as far as flexibility between pile and the body is concerned, because the pile is not woven into the body but is sewed to it with a catcher thread. Therefore, when Chenille pile is deflected under load it is free to roll without any sliding of the fibers one upon the other, and without any appreciable bending of the fibers. A Chenille carpet of proper density should therefore possess extremely good wearing quality, as far as flexibility is concerned.

CHAPTER XIII

HOW TO DISTINGUISH WOOL, COTTON,
LINEN AND JUTE

In examining threads of various kinds, it is advantageous to have two solutions, one acid and the other alkaline. The acid should be a 40 per cent. hydrochloric solution, while the alkaline solution may be made by dissolving one tablespoon



FIGURE 87

Plunging a thread or fiber end on into a glass of water permits the distinction of cotton from linen, the cotton glancing off and the linen piercing the surface of the water.

of lye in a pint of water. In making tests, both solutions should be boiling hot. In order to study a fiber, a thread should be removed from the fabric, and if it is one that has been treated in any way, it should be thoroughly washed so as to remove all sizing, gum, glue, or whatever may have been applied to the thread. Usually treatments of this kind do not penetrate to the center of the thread, so that clean fibers can be obtained by opening the thread with the point of a pen-knife. In addition to testing for solubility in acid or alkali, the thread can be cut with shears, singed with a match, plunged into water end on, combed out with the point of a knife, so as to separate the individual fibers and reveal the length and thickness when examined with the magnifying glass. In comparing threads of practically equal size, a great deal can be told by breaking the thread with the fingers.

Wool

The chief characteristics of wool are:

1. Slightly affected by hot hydrochloric solution.
2. Dissolves in boiling lye solution.
3. Curls and swells when burnt with a match giving off odor.
4. Fibers cling to one another when twist has been taken out.
5. Ends curl when broken.



FIGURE 88

Photomicrograph of wool magnified ninety diameters

6. Glances off when thread is plunged end on into water.
7. Easy to break.
8. When combed on the end with the point of a penknife fibers separate with a little fuzz.

Linen

The chief characteristics of linen are:

1. Dissolves slowly in hot hydrochloric acid solution.



FIGURE 89

Photomicrograph of linen magnified ninety diameters.

2. Slightly affected by boiling lye solution.
3. Ends even and compact when burnt with a match.
4. Fibers easy to separate when twist has been taken out.
5. Ends do not curl when broken.
6. Does not glance off when thread is plunged end on into water.
7. Hard to break.



FIGURE 90

Photomicrograph of cotton magnified ninety diameters.

8. When combed on the end with the point of a penknife, fibers separate with a little fuzz.

Cotton

The chief characteristics of cotton are:

1. Dissolves more quickly than linen in hot hydrochloric acid solution.
2. Is slightly affected by boiling lye solution.
3. Ends even and compact when burnt with a match.



FIGURE 91

Photomicrograph of jute magnified ninety diameters.

4. Fibers easy to separate when twist has been taken out.
5. Ends curl when broken.
6. Glances off when thread is plunged end on into water.
7. Easy to break.
8. When combed on the end with the point of a penknife, fibers become very fuzzy.

Jute

The chief characteristics of jute are:

1. Dissolves more quickly than cotton in hot hydrochloric acid solution.
2. Dissolves in boiling lye solution.
3. Ends even and compact when burnt with a match.
4. Fibers easy to separate when twist has been taken out.
5. Ends do not curl when broken.
6. Does not glance off when thread is plunged end on into water.
7. Fairly hard to break.
8. When combed on the end with the point of a penknife, fibers separate without fuzz.
9. Individual fibers extremely long.

CHAPTER XIV

CARE AND CLEANING OF CARPETS AND RUGS

The life of a rug is determined almost entirely by the care it receives. Of course, certain weaves will withstand hard usage very much better than others, and yet high price does not necessarily mean long life. In fact, some of the finest rugs are the ones that require the most careful handling.

Oriental rugs made hundreds of years ago are still in existence because they have received extraordinary care, and not on account of superior wearing qualities. An Oriental removes his shoes before walking on a fine rug. He knows just how the rug is made and takes care of it intelligently. He doesn't hang it over a line and beat it, or brush the pile the wrong way. If we were to subject rugs of this kind to the conditions encountered in many houses where there is a great deal of walking with heavy shoes that are many times none too clean, they would be found less satisfactory from a wearing standpoint than some of the machine-made carpets.

Grit

Grit is the greatest enemy of a carpet, because under the action of shoe heels or soles and moving

furniture it cuts the pile at its base, leaving the warp and weft bare. If it were not for grit, the pile or nap of floor covering would wear almost indefinitely. We cannot, however, prevent grit from getting into carpets. If it is not tracked in on shoes, it comes in through the windows. The important thing is to remove it before it has time to do any damage. Therefore rugs that must withstand heavy traffic should be cleaned as frequently as possible.

Lay of Pile

The pile of Oriental carpets always inclines in one general direction, called the "lay of the pile". Of the machine-made carpets certain types of Axminster have a distinct lay (see Figure 92). All other machine-made carpets are woven straight up, but where the pile is long or not very dense, it is sure to crush down as shown in Figure 82. Where pile is long and must develop a lay in use, it is important to encourage a lay in one general direction.

In a figured carpet the lay of the pile should point toward the strongest light, as in this way the pattern and colors are brought out in sharp distinction.

Single-tone carpets with the lay pointing toward the light will show spots where the lay is not exactly in the same direction and at the same angle as the rest of the pile. Spottiness or shading can be avoided by keeping the lay all in one direc-

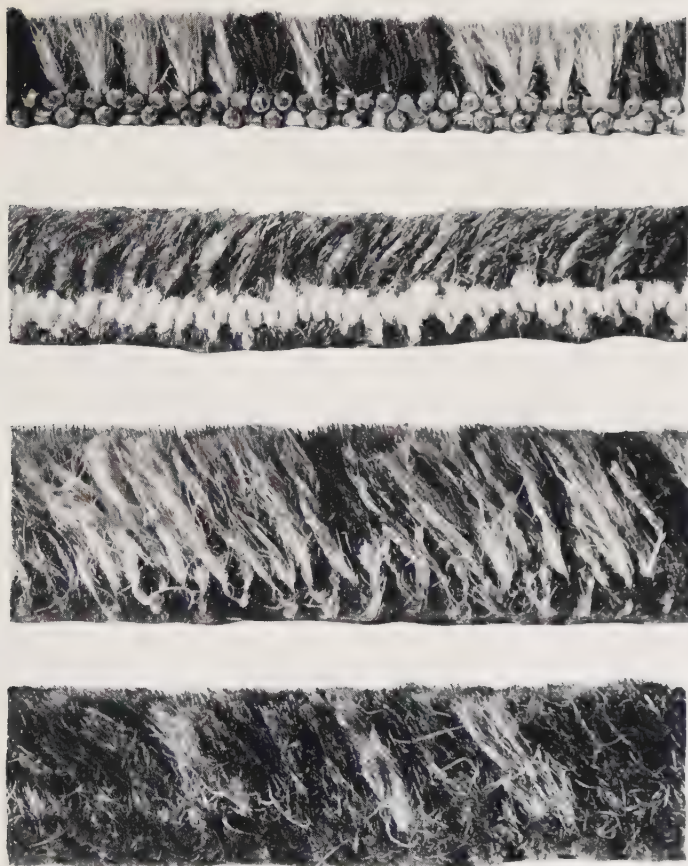


FIGURE 92

Most machine-made carpets are woven with the pile straight up, but if the pile is long and not extremely dense it will acquire a distinct lay in use. The top illustration is a cross-section of a three-shot Wilton. This type is woven straight up, and on account of the shortness of the pile and the density of the weave remains straight up under practically all conditions. The illustration next to the top is a cross-section of a Persian Oriental; the lay of the pile is characteristic of the weaving. The two bottom illustrations are cross-sections of Imperial Axminsters, the upper one being woven with worsted and the lower one with wool. This type of carpet is also woven with a distinct lay as is plainly evident from the illustration.

tion, and it is made very much less noticeable by having it point away from the strongest light. All carpets look lighter in color and show less contrast between colors when the lay points away from the light.

Entirely aside from appearance, it is extremely hard on carpets to brush the pile against the lay or to brush it first in one direction and then in the other, as bending the fibers sharply back and forth breaks them off at the base. It also loosens all the short pieces of fiber that are in the yarn and thus thins out the pile tufts—the final result being the complete wearing away of the pile, leaving only the body or warp.

Cleaning Carpets

There are a number of methods in use by housewives for cleaning carpets, the most important of which are:

1. Sweeping with the broom.
2. Sweeping with the carpet sweeper.
3. Shaking out of doors.
4. Hanging up or laying flat and beating out of doors.
5. Suction cleaning.
6. Suction sweeping.
7. Suction sweeping with vibration.

The Broom

Sweeping with a broom is the oldest and probably still the most common method of cleaning

carpets. It is hard for many house-wives to give up the broom even though they have available utensils which they recognize as more efficient.

The broom, though it has been used longer than any other utensil for cleaning carpets, does not thoroughly clean the carpet and unless used in a gentle manner is very detrimental to the fabric.

The ineffectiveness of a broom for cleaning purposes can be demonstrated by attempting to sweep a cup of sand or powder of any kind across a carpet. It will be found that before the sweeping has progressed very far, the sand or powder has disappeared into the carpet.

From observations made with special equipment and different operators, it was found that the average person presses a broom against the carpet with a force of from 7 to 10 pounds. Considering the harshness of the broom straws and the unyielding character of the floor which supports the carpet, it is easy to understand why sweeping with a broom wears out a carpet by abrasion. Entirely aside from the abrasive action, there is the wear that results from the presence of gritty dirt in the body of the carpet that has been forced in by sweeping with a broom.

From the standpoint of hygiene the broom is an arch offender. First of all sweeping is hard work; indeed physicians claim it contributes as much or more to the house-wife's fatigue than any other single duty she has to perform. Then when

used without moistening the carpet, the broom scatters germ-laden dust worse than any method of cleaning. The Anti-Tuberculosis League has labelled consumption as a "house" or "floor disease" and vigorously protests against "dry-broom sweeping."

In spite of all the disadvantages of the broom, it has some claim to a place in the house as an accessory to other and more efficient cleaning utensils. For instance, a light broom with a dust pan can be used advantageously for picking up crumbs



FIGURE 93

If the broom is swung too far the straws snap out and catapult the dirt into the air, scattering dust around the room.

and other surface litter at times when the entire surface of the carpet does not need to be swept.

In Figures 93 and 94 are shown two methods of handling the broom; one in which the bristles are pressed endways into the carpet and snapped out so as to catapult the dirt into the air, and the other in which the broom is dragged lightly over the surface of the carpet with the ends of the bristles always trailing slightly. The latter method will produce less dust and if used in the direction of the lay of the pile will remove crumbs and scraps better.



FIGURE 94

A broom can be used for picking up surface litter without scattering dust around the room, if it is dragged lightly over the carpet and never swung far enough to snap the straws to the front.

Ordinarily the broom is used with excessive pressure, which, together with the extremely hard, harsh nature of the bristles, causes excessive wear. A broom in the hands of a careless servant should never be used on a fine rug or carpet.

Carpet Sweeper

The carpet sweeper is an improved type of broom. It has the advantage over the broom of being easier to operate and of eliminating the use of the dust pan. It injures the carpet less than the broom because its bristles are not so hard, and a careless servant with a strong arm cannot press the bristles into the carpet as she does with the broom. Like the broom, the carpet sweeper gets only the surface dust and litter. It eliminates the scattering of heavy dust, but produces more fine dust than a properly manipulated broom. It brushes the carpet in opposite directions so that in case of rugs which have a definite lay of the pile, it may be more injurious than a properly used broom.

In spite of its disadvantages, the carpet sweeper has come into extensive use on account of the ease with which it can be used, and the speed with which the surface of a carpet can be cleaned. It makes an excellent auxiliary cleaning device and can be used to good advantage where surface cleaning alone is involved.

Perhaps the best example of the favorable use of

the carpet sweeper is in the dining room for picking up crumbs after a meal. However, it does not thoroughly clean the carpet and it does do a certain amount of damage to a fine rug, by brushing the pile in all directions. It is bound to leave the pile lying in the wrong direction at every point where the last motion of the brush was against the pile, and if there is walking on this part of the rug, damage will result due to the action explained in Figure 85.

Shaking

Small rugs that can be handled by one person are often picked up and shaken out of the window or outside the house on the lawn. This is about the worst thing that can be done to any rug, as it is bent sharply in one direction and then in another, and at the ends is snapped with considerable force. Breaking of a single thread of warp or weft might be a serious matter, as it may loosen and allow a large number of knots to fall out.

Shaking is also bad for rugs that have fringe as it frays the ends due to the snapping action. We all know how a flag is worn out by waving in the breeze. A rug would be destroyed much sooner than a flag if it were hung up in a similar manner.

Machine-made rugs that have a back stiffened by treatment with glue, or sizing, are damaged by vigorous hand shaking, which breaks the backing

and thus destroys the protection it was supposed to afford.

Beating

Beating a rug or carpet out of doors is a thorough but at the same time a most brutal method of cleaning. First of all a large rug or carpet should not be hung up on a line, as it strains the fibers, when bent at a sharp angle, to make them carry the weight of the entire rug. With an Oriental rug the result may be disastrous, while with a machine-made rug it may break the backing. In any case, it does damage and will shorten the life of any floor covering.

The damage that may be done by the beating independently of the strain of hanging depends entirely upon the manner in which it is done. Beating with a stick gives a concentrated blow and is very apt to injure the carpet, especially if it be an Oriental. However, there are carpet-beating instruments that are made of light material and are so constructed that they cover a comparatively large area, thus distributing the force of the blow sufficiently to prevent injury to the carpet. Therefore, unless an unusually strong man does the beating these implements do no serious damage.

If a carpet has to be beaten by hand it should not be hung on a line but should be laid flat on the grass with the pile down and beaten with a

light beater of large area; then it should be turned over and beaten with the pile up. The action of beating will bounce the dirt out of the carpet, after which the major portion of the dirt can be swept off with a broom. By repeated beatings



FIGURE 95

A carpet can be thoroughly cleaned by the back-breaking process of beating on the grass, and then sweeping away the dirt that falls on the surface. By repeating this process until no more dirt can be extracted, the carpet can be thoroughly cleaned.

and sweepings, a carpet can be thoroughly cleaned, although it is a slow and difficult job, and few people attempt it more than once or twice a year.

Suction Cleaning

Air in motion possesses the power to carry with it material particles and other objects. This carrying-power depends partially on the speed at which the air moves. In nature the carrying power of air is exemplified by the cyclone and the tornado; in the industries this same power is utilized for conveying materials, such as coal dust, ashes, sawdust, wool, cotton, etc., through tubes by the passage of air at high speeds.

Air is set in motion by differences in pressure. If the difference in pressure is brought about by *increasing* the pressure in one place above the atmospheric pressure, the air is *compressed* and when released it flows out of the system, in which it has been confined, at a speed determined by the pressure. If the pressure difference is caused by *reducing* the pressure in a space below the atmospheric pressure, air is drawn in from the outside when an opening is made, and the action is described as *suction*.

A perfect vacuum is a space where there is nothing, but practically speaking a vacuum is any space where the pressure is below the atmospheric pressure. In fact, many people refer to the re-

duced pressure itself as a vacuum. In reality a vacuum has no cleaning power. Its usefulness resides in its power to move air toward the vacuum chamber. Suction cleaning employs a reduced pressure to create a partial vacuum into which air rushes through the cleaning tool, which is applied to the surface of the carpet or fabric to be cleaned.

It requires only a small difference in pressure to produce a high velocity of air providing there is free passage for the air. In nature we have a proof of this in the winds. Terrific winds are caused by comparatively slight differences in barometric pressure between one point and another, the air rushing into the space where the pressure is low from the space where the pressure is higher. However, if air has to pass through a dense fabric it requires a higher vacuum to produce the speed because the friction of the fabric is a speed reducer.

When cleaning a carpet, the suction cleaner is placed upon the floor in such a way that its opening is sealed by the carpet. The tighter the seal, that is, the harder the tool is pressed against the floor, the less will be the volume of air flowing through the fabric and therefore the less the cleaning effect, as the dirt carried depends on the volume of air in motion as well as on the air speed.

Figure 96 shows a cross-section of a suction cleaner. Across the bottom face we have less than atmospheric pressure. Across the top we

have the normal atmospheric pressure. The result is that the cleaner is pressed down into the carpet, and squeezed tightly against it both by this pressure and by hand; therefore whatever air enters must pass down into the carpet and up again. The path taken by the air will depend to a large extent upon the structure of the carpet, as

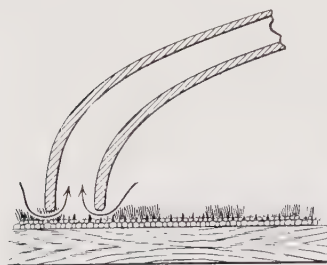


FIGURE 96

A plain suction nozzle presses the carpet tightly against the floor, sealing the opening. It is only by agitating the nozzle over the carpet that cleaning with this sort of a tool is possible.

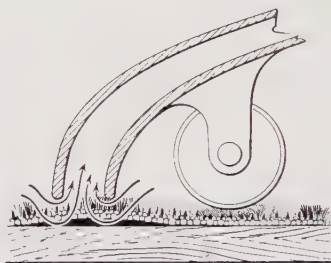


FIGURE 97

Mounting the cleaning tool on rollers permits the lifting of the carpet from the floor and greatly increases the cleaning effectiveness of the nozzle by allowing more air to pass through the nozzle.

it will always take the path of least resistance. A Wilton carpet is probably best adapted to pure suction cleaning, but even in this case it cannot be expected to clean at or below the base of the pile.

If the nozzle of the cleaning instrument were mounted on rollers so that it remained parallel and at a definite distance from the floor as shown in Figure 97, the carpet would be raised by the suction and the flow of air would be promoted, because there would be no squeezing of the carpet

between the lip of the nozzle and the floor. Naturally, too, the pile would be crushed less than in the former case.

Experiments show that for air to do the most effective cleaning it must pass from the top down under the lip. Experiments also show that air passing through the carpet from the bottom has little cleaning effect. (See Figure 97.) In fact, it may be actually detrimental because it is possible for dirt to be carried from the floor into the carpet and left there by air flowing this way.

The straight suction cleaner has the disadvantage of requiring a considerable amount of mechanical labor on the part of the operator, because the air will not clean the carpet unless the pile is agitated by moving the cleaner over its surface in a more or less vigorous fashion.

Not only is this agitation of the carpet by scrubbing its surface with the cleaner tiresome to the operator, but it is also injurious to the carpet.

Suction Sweeping

An improvement over the simple vacuum cleaner is the vacuum sweeper. Sweeping, as is explained under the "Broom" on page 139, is a satisfactory method of removing surface litter and dust. Therefore, the combination of a brush and a suction nozzle is an improvement, in that a portion of the cleaning is done by the brush in a more effective way than is possible with suction alone.

Consequently, the carpet is cleaned with less effort, and thus with less damage.

Brushes have been applied in various ways for this purpose. There are three general methods, namely; stationary brush, friction-driven brush and motor-driven brush.

The stationary brush may be mounted within the nozzle opening; in front of it, or behind it, but no matter where it is, it tends to clog. If it is placed inside the nozzle, it will brush up surface litter until it is filled solid with dust and lint that has been dragged into it by the current of air. If it is placed outside, it must hold all it picks up as it has no way of clearing itself. Another disadvantage of the stationary brush is that the brush moves at the same speed as the cleaner, which is too slow to do much sweeping.

The brush which revolves by friction rollers is better but is subject to the same disadvantages as the carpet sweeper. It brushes the pile in both directions. Deriving its power from the carpet itself, it exerts a pull on the fibers and therefore accelerates their deterioration. A brush of this kind does not clear itself properly because its speed is not sufficiently high to produce the centrifugal force necessary to throw out the dirt that clings to it.

The motor-driven brush has three advantages over the friction-driven brush. First, the power required to drive is not derived from the carpet

and therefore no tractive effort is exercised on the carpet. Second, the speed may be high enough to produce the centrifugal force required to clear the brush. Third it revolves always in one direction, instead of reversing with each hand stroke, and therefore is not a factor in the disturbance of the lay of the pile. This advantage does not amount to much, however, when the motor-driven brush is combined with a nozzle, the lips of which are pressed against the carpet so that the pile is rubbed first in one direction and then in the other.

To sum up, the addition of a brush to the suction cleaner has contributed one valuable element to the cleaning properties of the plain suction machine, namely; the removal of surface litter. Further, no disadvantages result if the brush is right; that is driven always in one direction and at a high speed of rotation.

Vibration

In analyzing the principles involved in thorough cleaning, we find that the old-fashioned methods point the way. When it was desired to get the dirt and embedded grit out of a carpet, it was beaten, and this work was done out of doors where the wind could carry off the dust and dirt. If the action of beating is analyzed, it is found that its cleaning effect is due to the inertia of the dirt. When the carpet receives a blow it is forced to move, because the various parts are tied to-

gether and must move. The dirt, however, can only be carried with the carpet in its motion by the force with which it sticks to it. If the carpet can be moved quickly enough, the force which holds the dirt will be overcome and the dirt will be left behind. When the carpet vibrates back to its original position it pushes the dirt still further in the direction in which it is moving. In other words, the reason beating cleans a carpet is that beating vibrates the carpet.

Beating a carpet also loosens embedded grit and dirt due to the flexing of the fabric, which causes relative motion between the adjacent threads and prepares the way for bouncing the dirt out when the vibration takes place.

It is plain that if we are able to vibrate a carpet mechanically and yet not bend it through any sharp angles or beat it with too powerful blows, that we shall be able to remove the dirt with a minimum effort, and therefore with a minimum of damage to the fabric. In fact, the damage done by a cleaning operation can to a certain degree be measured by the amount of effort involved in getting a given result.

The problem of applying the actions of beating, sweeping and carrying away the dirt with a current of air was solved when the idea of mounting a suction sweeper with motor-driven brush at an *adjustable distance above* the floor was conceived.

Vibration and the wonderful cleaning efficiency which it possesses can never be attained by apply-

ing a revolving brush to a carpet that lies flat on the floor. If a carpet is to be beaten by hand, it is not laid on a cement pavement, but is hung up on a line or laid on the grass, the whole purpose being to allow the carpet to move under the action of the blow. The force of the blow will not clean the carpet unless the carpet can move. Beating a carpet when it is lying flat on the floor will not clean it as much as it will punish it, because the only motion that can be attained will be that due to the resiliency of the carpet itself.

Hoover Suction Sweeper

The Hoover Suction Sweeper is the machine in which the principles above set forth have been combined. This machine is mounted on rollers so that the cleaning nozzle is carried at an adjustable distance from the floor. The opening in this nozzle is made so large that it does not require a high vacuum to lift the carpet off the floor. The face of the opening is covered with a brush guard which prevents the carpet from being drawn into the nozzle, holding it across the opening and eliminating any possibility of sharp bending of the fibers.

In this opening or nozzle is mounted a brush that is driven by the motor. The bristles of this brush are arranged on a spiral and are of such length that they project approximately $\frac{1}{8}$ inch below the surface of the carpet guard. Therefore,

with each revolution of the brush the carpet at any one point is deflected approximately $\frac{1}{8}$ of an inch.

The brush revolving at approximately 1000 revolutions per minute has two diametrically opposite tufts of bristles (see Figure 98) so that the carpet is vibrated approximately 2000 times a minute. In short, the brush not only sweeps the carpet but also it beats it, and it does this beating against a perfectly resilient cushion of air between carpet and floor.

As a matter of fact, in operation this cleaner utilizes three sets of vibrations. First, there is a slow wave-like motion of the carpet produced by the passage of the cleaner over its surface. Second, there is a smaller wave-like motion which travels lengthways of the nozzle opening, the wave being produced by the spiral arrangement of the bristles. As at present constructed, three bristles are always in contact with the carpet, pushing it down in the form of a cup-shaped depression. As the brush revolves this depression travels along the opening. The action is similar to the playing of a scale on a piano. The third vibration has a high frequency and is caused by the beating action of the brush.

The slow wave-like motions produce a gentle shaking, manipulating the fabric in such a way as to loosen all embedded grit, while the high frequency vibrations caused by beating bounce the

dirt and grit out of the fabric, so that it can be carried off by the current of air.

The vibration of the carpet also has an important effect on the current of air because it rapidly opens and closes the suction opening, and allows much more air to pass through the cleaner than would be possible if the carpet completely and continuously sealed the opening, as is the case with the ordinary suction cleaner.

Summing up the above, we find that the Hoover gives the carpet a scientific and automatically controlled cleaning. It beats the carpet on a cushion of air which is far superior to a cushion of grass; it shakes the carpet by lifting it from the floor as

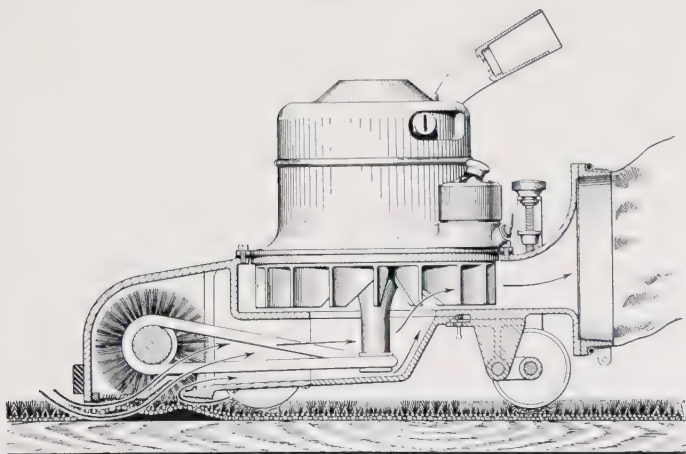


FIGURE 98

The Hoover being mounted on wheels lifts the carpet from the floor, in which position the brush sweeps the surface and beats it against an air cushion, the air in the meantime carrying off the loosened dirt and depositing it in a bag.

it passes over, and this shaking is done without any sharp bending or snapping; it sweeps the carpet with a soft brush while the carpet is supported on a cushion of air, and finally all the dirt that is loosened by the manipulation and vibration of the fabric as well as by the sweeping of its surface is carried off by a swift current of air.

A most important advantage of the Hoover is the favorable action it has upon the pile of the carpet. First of all the brush being motor-driven revolves always in the same direction, so that no matter which way the cleaner is moved, the brushing action on the carpet is always in the same direction, and therefore, if the cleaner is properly operated the pile will always be left lying in its natural position after the cleaning operation is over.

Due to the fact that the carpet is lifted from the floor and an air cushion is maintained below it, there is no rubbing or abrasive action at the sides of the nozzle. In fact, it only requires one ounce of contact pressure by the brush to push the carpet away from the nozzle. When this pressure on the carpet against an air cushion is compared with the 7 or 10 pounds of broom pressure against an unyielding floor, it is easy to realize why a Hoover cleaner is not at all injurious to carpets.

It is a fundamental principle of cleaning that dirt can be removed from a carpet only by doing work upon the fabric, and since the fabric must withstand the cleaning efforts, it is desirable to

employ methods that get the most dirt with the least effort. There is no one cleaning method which is as efficient as the proper combination of several principles working in harmony. The Hoover utilizes all the cleaning principles, and years of study and experiment have been spent in proportioning the application of these principles, so as to get the desired cleaning effect with the minimum amount of work, and therefore, with a minimum deterioration of the carpet. In fact, there is no known method by which a given cleaning result can be obtained with so little harm to the carpet and so little effort by the user as with the Hoover Suction Sweeper. Consequently, it is recommended unreservedly for use on the finest rugs.



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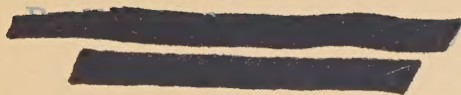
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